SYLLABUS
ENGLISH CORE (301)
CLASS XII (2013-14)

One Paper
3 Hours
Marks: 100

Unit-wise Weightage

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<th>Unit/Area of Learning</th>
<th>Marks</th>
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<td>(i) Flamingo</td>
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SECTION-A

Reading unseen Passages and Note-making 20 Marks 40 Periods

Two unseen passages with a variety of questions including 03 marks for vocabulary such as word formation and inferring meaning and 05 marks for note-making.

The total length of the two passages will be between 950-1200 words. The passages will include two of the following:

(a) **Factual Passages** e.g. instructions, descriptions, reports.
(b) **Discursive passage** involving opinion e.g. argumentative, persuasive or interpretative text.
(c) **Literary passage** e.g. extract from fiction, drama, poetry, essay or biography

<table>
<thead>
<tr>
<th>Unseen passages</th>
<th>No. of words</th>
<th>Testing Areas</th>
<th>Marks Allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>600-700</td>
<td>Short answer type questions to test local, global and inferential comprehension, Vocabulary</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>350-500</td>
<td>Note-making in an appropriate format Abstraction</td>
<td>08</td>
</tr>
</tbody>
</table>

A passage of about 600-700 words carrying 12 marks and another passage of about 350-500 words carrying 08 marks

1. A passage to test reading comprehension. The passage can be literary, factual or discursive. The length of the passage should be between 600-700 words. 12
2. A shorter passage of 350-500 words for note-making and abstraction. 8
SECTION B

Advanced Writing Skills 35 Marks 70 Periods

3. **One** out of two short compositions of not more than 50 words each e.g. advertisement and notices, designing or drafting posters, writing formal and informal invitations and replies. 05

4. A report or a factual description based on verbal input provided (one out of two) (125-150 words) 10

5. Writing **one** out of two letters based on verbal input. Letter types include:

   (a) business or official letters (for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies):

   (b) letters to the editor (giving suggestions on an issue)

   (c) application for a job

   (d) letter to the principal or school authorities regarding admissions, school issues, requirement or suitability of course etc. 10

6. **One** out of two compositions based on visual and/or verbal input (125-150 words). Output may be descriptive or argumentative in nature such as an article, or a speech or a debate. 10

SECTION C

Literature Textbooks and Long Reading Texts 30+15 = 45 Marks 100 Periods

**Prescribed Books:**

Flamingo and Vistas 30

7. **One** out of two extracts based on poetry from the text to test comprehension and appreciation 04

8. **Two** out of three short questions from the poetry section to test local and global comprehension of text. 04

9. **Six out of seven** short answer questions based on the lessons from Flamingo and Vistas. 12

10. **One** out of two long answer type questions based on the text to test global comprehension and extrapolation beyond the set text. (Expected word limit about 100-125 words each) 05

11. One long answer question based on texts to test comprehension and analytical skills which bring out the **inherent values and key messages** in about 100 words. 05
The following lessons will not be tested in the examination:

<table>
<thead>
<tr>
<th>Name of the Textbooks</th>
<th>Name of the Lessons Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flamingo</td>
<td>1. Poets and Pancakes</td>
</tr>
<tr>
<td></td>
<td>2. The Interview</td>
</tr>
<tr>
<td></td>
<td>3. A Road Side Stand (Poetry)</td>
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<tr>
<td>Vistas</td>
<td>4. The Third Level</td>
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<td></td>
<td>5. Journey to the End of the Earth</td>
</tr>
</tbody>
</table>

With a view to instil the habit of reading among the students, the CBSE has introduced compulsory reading of Long Reading Text/ Novel in English Core Course. The assessment will be done in the term end examinations.

Q. 12 & 13. There will be two long answer questions on the theme, plot, character and incidents from the prescribed novel. Schools can choose any one out of the two novels prescribed.  

\[ 8 + 7 = 15 \text{ Marks} \]

**Prescribed Books:**


**Long Reading Text/ Novels**

- **Lord of Flies** (unabridged 1954) by William Golding (deleted from the syllabus w.e.f. 2013-14 onwards)

  OR

- **Hound of Baskervilles** (unabridged 1902) by Arthur Conan Doyle
Q. 1. Read the passage given below and then answer the questions which follow: 12 marks

1. In spite of all the honours that we heaped upon him, Pasteur, as has been said, remained simple at heart. Perhaps the imagery of his boyhood days, when he drew the familiar scenes of his birthplace, and the longing to be a great artist, never wholly left him. In truth he did become a great artist, though after his sixteenth year he abandoned the brush forever. Like every artist of worth, he put his whole soul and energy into his work, and it was this very energy that in the end wore him out. For him, each sufferer was something more than just a case that was to be cured. He looked upon the fight against hydrophobia as a battle, and he was absorbed in his determination to win. The sight of injured children, particularly, moved him to an indescribable extent. He suffered with his patients, and yet he would not deny himself a share in that suffering. His greatest grief was when sheer physical exhaustion made him give up his active work. He retired to the estate at Villeneuve-Etang, where he had his kennels for the study of rabies, and there he passed his last summer, as his great biographer, Vallery Radot, has said, “practicing the Gospel virtues.”

2. “He revered the faith of his fathers, “says the same writer, “and wished without ostentation or mystery to receive its aid during his last period.”

3. The attitude of this man to the science he had done so much to perfect can be best summed up in a sentence that he is reputed once to have uttered, concerning the materialism of many of his contemporaries in similar branches of learning to his own: “The more I contemplate the mysteries of Nature, the more my faith becomes like that of a peasant.”

4. But even then in retirement he loved to see his former pupils, and it was then he would reiterate his life principles: “Work, “he would say, “never cease to work.” So well had he kept this precept that he began rapidly to sink from exhaustion.

5. Finally on September 27, 1895, when someone leant over his bed to offer him a cup of milk, he said sadly: “I cannot, “and with a look of perfect resignation and peace, seemed to fall asleep. He never again opened his eyes to the cares and sufferings of a world, which he had done so much to relieve and to conquer. He was within three months of his seventy-third birthday.
6 Thus passed, as simply as a child, the man whom the French people were to vote
at a plebiscite as the greatest man that France had ever produced. Napoleon, who
has always been considered the idol of France, was placed fifth.

7 No greater tribute could have been paid to Louis Pasteur, the tanner’s son, the scientist,
the man of peace, the patient worker for humanity.

1.1 Answer the following questions:

a. Even accolades and honours did not change the simple man that Pasteur was.
Give reasons. 2 marks
b. How did Pasteur view those who suffered from diseases? 1 mark
c. How did Pasteur engage himself in the estate? 2 marks
d. What advice did he always give to his pupils? 2 marks
e. How did France, the country of his birth, honour this great scientist? 2 marks

1.2 Find the words from the passage which mean the same as: 3 marks

a. to give up (para 1)
b. people belonging to the same period (para 3)
c. vote by the people of the country to decide a matter of
   national importance (para 6)

Q. 2. Read the passage given below: 8 marks

Residents of the Bhirung Raut Ki Gali, where Ustad Bishmillah Khan was born
on March 21, 1916, were in shock. His cousin, 94-year-old Mohd Idrish Khan
had tears in his eyes. Shubhan Khan, the care-taker of Bismillah’s land, recalled:
“Whenver in Dumaraon, he would give rupees two to the boys and rupees five
to the girls of the locality.”

He was very keen to play shenai again in the local Bihariji’s Temple where he
had started playing shenai with his father, Bachai Khan, at the age of six. His
original name was Quamaruddin and became Bishmillah only after he became
famous as a shenai player in Varanasi.

His father Bachai Khan was the official shenai player of Keshav Prasad Singh,
the Maharaja of the erstwhile Dumaraon estate, Bismillah used to accompany
him. For Bishmillah Khan, the connection to music began at a very early age. By
his teens, he had already become a master of the shenai. On the day India gained
freedom, Bismillah Khan, then a sprightly 31-year-old, had the rare honour of
playing from Red Fort. But Bishmillah Khan won’t just be remembered for
raising the shenai from an instrument heard only in weddings and naubatkhanas
to one that was appreciated in concert halls across the world. His life was a
testimony to the plurality that is India. A practising Muslim, he would take a daily
dip in the Ganga in his younger days after a bout of kusti in Benia Baga Akhada.
Every morning, Bishmillah Khan would do riyaaz at the Balaji temple on the
banks of the river. Even during his final hours in a Varanasi hospital, music didn’t
desert Bishmillah Khan. A few hours before he passed away early on Monday, the shehnai wizard hummed a *thumri* to show that he was feeling better. This was typical of a man for whom life revolved around music.

Throughout his life he abided by the principle that all religions are one. What marked Bishmillah Khan was his simplicity and disregard for the riches that come with musical fame. Till the very end, he used a cycle rickshaw to travel around Varanasi. But the pressure of providing for some 60 family members took its toll during his later years.

2.1 On the basis of your reading of the above passage make notes using headings and sub-headings. Use recognizable abbreviations wherever necessary.  

2.2 Make a summary of the above passage in not more than 80 words using the notes made and also suggest a suitable title.

**Section – B Advanced Writing Skills**

Q.3 A.K International School is looking for a receptionist for the school. Write an advertisement on behalf of the administrative officer in the classified columns of the local newspaper giving necessary details. Draft the advertisement in not more than 50 words.

**OR**

Suman/Suresh has cleared the Pre-Medical Pre-Dental entrance examination. The family is elated at the achievement and they decide to have a get-together for all friends. Draft an informal invitation for the get-together.

Q.4 You are Shekhar/Tripti a student of A.P Public School. Principals of two schools from Bhutan visited your school as part of a cultural exchange programme. Students of the school put up a cultural show in their honour. Write a report of the programme for your school magazine. (125-150 words)

**OR**

It was raining heavily. You were walking to your house after the school, when suddenly you saw a huge Neem tree coming down and falling on the pavement and the road thereby hitting a car parked on the pavement. The traffic came to a standstill. Describe the chaotic traffic scene in 125-150 words.

Q.5 You are Nitin/Natasha a student of Class XII at K.P.N. Public School Faridabad. A student is required to cope with a lot of peer pressure in today’s competitive environment. Write a letter to the editor of a national daily highlighting the kind of pressures an adolescent faces and suggest ways to cope with the same.

**OR**

You are Suresh/Smita. You come across the following advertisement in a national daily. You consider yourself suitable and eligible for the post. Write an application in response to the advertisement given below:
Application are invited for the post of a Nursery Teacher in a reputed school of Delhi. The candidate must have at least 05 years experience of teaching tiny-tots. The applicant must have a pleasant personality. He/she should be creative and innovative. Attractive salary. Interested candidates should apply to The Principal, AKS International, Indirapuram, New Delhi within 10 days with detailed resume.

Q. 6. There has been wide spread devastation caused by the ‘Himalayan Tsunami’ in Uttarkhand state of India. Multiple reasons have been attributed to the havoc caused by heavy rains. Write an article highlighting the steps taken by the administration to rescue and evacuate the people from the flood hit areas. Also express your opinion on how this kind of tragedy can be averted in future. You are Manish/ Micky

(150-200words) 10marks

OR

Computer games and video games have become popular with children today. As a result outdoor games seem to have no place in their life anymore. You are Mukesh/ Meena. You decide to write a speech to be delivered in the school assembly on your experiences about the joys of playing outdoor games.

(150-200 words) 10marks

Section – C Textbooks and Long Reading Text 30+15 = 45 Marks

Read the following extract from the poems and answer the questions that follows:

Any One

Q. 7. They do not fear the men beneath the tree;
They pace in sleek chivalric certainly. 1x4 = 4 marks

a. Are Aunt Jennifer’s tigers real? Give reasons for your answer. 2
b. Why do the tigers not fear the man beneath the tree? 1
c. What do you understand by ‘chivalric certainty’? 1

OR

A thing of beauty is a joy for ever
Its loveliness increases, it will never
Pass into nothingness; but will keep
A bower quiet for us.

a. ‘A thing of beauty is joy for ever’. Explain 2
b. Why does a beautiful thing ‘pass into nothingness”? 1
c. What does poet mean by ‘a bower quiet for us’ 1

Q. 8. Answer any two of the following questions in about 30–40 words. 2x2= 4 marks

1. According to Pablo Neruda, what is it that human beings can learn
from Nature?
2. Why does Spender call Shakespeare wicked and the map a bad example?
3. What is the significance of the parting words of the poet and her smile, in
   My Mother at Sixty-six.

Q.9. **Answer any six of the following questions in about 30-40 words.** 2x6= 12 marks
   a. For Franz, what was much more tempting than going to school and why?
   b. Mention any two hazards of working in the glass bangles industry.
   c. How did Douglas overcome the old terror?
   d. The crofter can be called as a good host. Give Reason.
   e. Even though the Maharaja lost three lakhs of rupees, he was still happy. Why?
   f. Why did Roger Skunk go in the search of the wizard?
   g. Mention any two reasons because of which it would take thirty minutes to an hour for
      Bama to reach home?

Q.10. **Answer any one of the following in about 100-125 words.** 5 marks
      Franz’s attitude towards school as well as towards M. Hamel changes when he
      comes to know about the takeover of his village by Prussians. Do you agree?
      Discuss with reference to the The Last Lesson.
      OR
      “The duty of a doctor beckoned Dr. Sadao in helping the injury soldier. “But what
      made his wife Hana empathies with him in the face of open defiance from the
      domestic staff?

Q. 11. **Read the following and answer the question that follows:** 5 marks
      After reading the story ‘The Rattrap’, you feel that moral virtues can change a person’s life. These
      play a vital role in the moral and spiritual development of a human-being. ‘An eye for an eye will
      make the whole world blind.’ It is through fellow-feeling, love, compassion and trust in others that
      can help reform the society. Write a paragraph on ‘ways to reform a wayward personality’ in about
      100 words.

Long Reading Text – The Hound of Baskerville

Q.12  What is the role Dr. J. Watson in the novel ‘The Hounds of Baskerville’? What characteristics
      make him a real assistant as a private investigator? Write your answer in about 125 words. 8 marks

Q.13  What was the legend behind ‘The Hound of Baskervilles’? What was the most recent event that
      occurred in support of this myth? 7 marks
ENGLISH CORE
CODE NO.: 301
Class-XII
SAMPLE QUESTION PAPER

Marking Scheme

Max. Marks: 100

Section – A
Reading

Q. 1 Answer Key 1.1

1.2  a- abandoned  3 marks
b- contemporaries
c- Plebiscite

Q. 2.1. Title: ‘Tribute to Bismillah Khan’ or accept any appropriate or relevant title. 5 marks

Notes

1. Shock at the demise
   (a) Cousin- tears in eyes.
   (b) Care-taker recalled-
       (ii) Giving two Rs. - boys
       (iii) Five Rs. to girls

2. His early life
   (a) Org. name Quamaruddin
   (b) Play shehnai at temp. - with father
   (c) Recognized as Bismillah- at Vns.
3. Music as Family heritage:
   (a) father - court poet at Dumaraon
   (b) pld. shehnai from age six
   (c) at 31- played shehnai - Red Fort- 1947.

   (a) taking dip in the Ganga
   (b) riyaaaz at Balaji Temp.
   (c) before his last breath- hummed thumri
   (d) used cycle rickshaw to travel
   (e) bread-winner for 60 fml. mem.

5. Bismillah beyond religion
   (a) main principle- all religions one
   (b) life -testimony of plurality
   (c) pract. Muslim

<table>
<thead>
<tr>
<th>Key to Abbreviations used:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
</tr>
<tr>
<td>Vns.</td>
</tr>
<tr>
<td>Pract.</td>
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<tr>
<td>Rs.</td>
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<tr>
<td>Pld.</td>
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<tr>
<td>Fml.</td>
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<tr>
<td>Mem.</td>
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</table>

2.2. Summary of the passage 3 marks

Ustad Bismillah Khan born and brought up at Dumaraon got the taste of music at a very early stage of life. He started accompanying his father who was an official musician at the Estate of Dumaraon. He got the honour to play his thumri tune at Red Fort on the occasion of Independence. He believed that all religions are one. He led a life of simplicity. Music was his soul and even on his deathbed he played his last thumri in the hospital at Varanasi.

Section – B

Q. 3. Option -I

Advanced Writing Skills 10 marks

Objectives: To draft a classified advertisement giving all the necessary details.

Marking: 5 marks

Title : Situation Vacant 1 mark
Content: Details
- Educational Qualifications
- Spoken English
- Age
- Pleasant personality
- Whom to apply to and contact address
- Last date

Expression: Coherence, Relevance
Grammatical accuracy, spelling

Option II
Format
Address of self
Date
Salutation

Content: Details
- What is the occasion
- Date and time
- Venue
- Theme for the party

Expression: Coherence, Relevance
Grammatical accuracy, spelling

Q. 4 Option I

Report
Format
Heading/Title
Name and class of the student

Content
What?
When?
Where?
Who organized it?
Highlights of the guest’s speech
Any other relevant information

Expression
spelling, grammatical accuracy
coherence, relevance
Option II

Factual Description

<table>
<thead>
<tr>
<th>Content</th>
<th>Value Points</th>
<th>4 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of accident site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition of occupants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of occupants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition of the vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of ambulance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Expression                | Coherence and relevance        | 3 marks |
|                          | Grammar and spelling           | 3 marks |

Q. 5. Option I  10 marks

Format
Writer’s address, receiver’s address, date, subject, salutation and complementary close  2 marks

Content
Reasons for stress  5 marks
- The increasing competition among students to score high marks
- No time for recreation
- Manifestation of stress in the form of anger, violent behaviour
- Indulging in games, practising yoga, can combat stress
- Listening to music etc are also ways of cop with stress

Expression
Coherence, relevance  3 marks
spelling, grammatical accuracy

Option II

Format
Writer’s address, receiver’s address, date, subject, salutation and complementary close.  2 marks

Content
Covering letter  3 marks
Reference to advertisement
Conveying suitability for the post
Submission of application
Resume/ Biodata as separate enclosure
Profile of self
Educational Qualifications
Professional Qualifications  
Experience  
Any other relevant information  

<table>
<thead>
<tr>
<th>Expression</th>
<th>Spellings, grammatical accuracy, relevance</th>
<th>2 ½ marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coherence and cohesion</td>
<td>2 ½ marks</td>
</tr>
</tbody>
</table>

Q. 6. Option: I  
10 marks  

Article- Argumentative  

<table>
<thead>
<tr>
<th>Format</th>
<th>Title, writer’s name</th>
<th>1 mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Title – ‘The Himalayan Tsunami’</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content</th>
<th>4 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- wide spread devastation caused by heavy rains due to cloud burst</td>
</tr>
<tr>
<td></td>
<td>- Unmindful exploitation of hilly terrain.</td>
</tr>
<tr>
<td></td>
<td>- Soil erosion due to illegal</td>
</tr>
<tr>
<td></td>
<td>- Constructions</td>
</tr>
<tr>
<td></td>
<td>- Unpreparedness of disaster management teams/ agency</td>
</tr>
</tbody>
</table>

| Steps: | |
|--------| |
| - wide scale evacuation |
| - all government agencies at work |
| - ITBP, BSF, Army, Airforce |
| - Local administrative machinery |
| - Taking cognizance of CAG’s reports, Disaster Management team etc. |

<table>
<thead>
<tr>
<th>Expression</th>
<th>Coherence, relevance</th>
<th>2 ½ marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spelling, grammatical accuracy</td>
<td>2 ½ marks</td>
</tr>
</tbody>
</table>

Option II  

- Outdoor games make us physically active, agile and alert  
- Playing and running around with friends makes us happy  
- It is exciting when we play, fight, agree and disagree  
- Lot of exchange of ideas and thoughts  
- Increase in number of friends hence social circle is broadened  
- More joyful than sitting alone on computers and chatting
Section – C Textbooks

Q. 7. Objectives: To test the students comprehension of the poem, their ability to interpret, evaluate and respond to the lines of the poem.

Option - I Value points:
marks

(a) No,
• they are on a screen
• can be seen on a panel marks
(b) Symbol of chivalry
• they are powerful mark
(c) they are sure of their power
• and the strength they possess mark

Option - II Value points:
marks

(a) Long lasting impact
• never move into emptiness
• we even think of them in our dream mark
(b) long standing impression mark
• not subject to time
(c) a shady place for one to sit and ponder mark

Q. 8. Any two marks

1. to be quiet and still
• to grow at our own place
• to be contented what we had (any two points)
2. He says so
• These have no meaning for children of slum
• They will tempt them to steal
3. It signifies hope
• Promise of visiting the mother again
• To leave a smiling face behind for her mother, (any two)

9. Any Six
**Objectives:** To be able to comprehend incidents and evaluate it.  

2x 6 = 12 marks

**Marking Scheme:**

**Content:** 1 mark

**Expression:** 1 mark

**Value Points**

a. Going out to play in bright warm sun
   - With birds chirping in open field
   - To see the Prussians soldiers practicing drill
   - More tempting than learning the rules for participles

b.
   - the chances of losing one’s eye-sight
   - there is possibility of skin burn too

c. he confidently continued to swim on
   - the next morning he dived into the lake, swam across to the other shore and back. this way he conquered his fear of water.
   - the will to live helped him in conquering his fear.

d. He welcomed the tramp
   - offered him hot supper
   - gave him tobacco to smoke
   - played cards with him

e. Maharaja had bought fifty diamond rings
   - sent it to the wives of British officers to choose from
   - they kept all of them
   - but managed to retain his kingdom
   - this made him happy

f. Every body made fun of Roger Skunk because he gave out a bad smell.
   - he was upset about this
   - He met the old owl who advised him to go to the wizard, which would help him and give him a pleasant smell.

g. The two reasons are:
   - She would watch all the fun and games that were going on the road
   - She would look at the shops and the bazaars
   - Used to look at the snake charmers and the monkey performing, (any two)
Q. 10. Option I

Objectives: To test global comprehension of prose texts

Marks

Marking Scheme: Content: 3 marks
Expression: 2 marks

Value Points:
- Franz decided to pay attention to the lesson
- School became very important for him
- Felt he would miss his school from next day
- M. Hamel became a good teacher from a boring one.
- Genuinely upset that Hamel was leaving the village
- Cranky Hamel seemed a good gentle man
- Liking developed for history and grammar.

OR

Option II

Marking Scheme: 5 marks

Content: 3 marks
Expression: 2 marks

Dr. Sadao’s compulsion of - The enemy soldier was professionally – Justifiable - Hana - no such compulsion - She supported the decision of her husband – Hana - more than one reason to be sympathetic – wifely compulsion of her pledge of supporting the husband a woman and - instinctively are preservers and not destroyers. – there is a mother in woman- educated woman – logical assessment – justifiably sympathetic towards the prisoner of war in spite of – vehement objections and defiance of the servants and the risks involved.
11. Value Based Question

Marking scheme  

Content—3  
Expression—2  

Value points: Students may cover any three of the following points.  
Accept any other point if it is relevant.

Suggested Value Points:

- A smooth and peaceful life - important in our life.
- A troubled and tensed life - meaningless – brings along many ailments and problems.
- Inculcating values like truthfulness, punctuality, regularity, fellow-feeling, sympathy and a selfless service – life becomes a boon for all.
- Must learn to pay due respect to our elders and love needy, poor and our young-ones – be a role model for others.
- Bad habits are mental vices - turn us addict - become habitual.
- Student life - best platform to attain as well as earn these virtues.
- Qualities like truth, fellow-feeling, sympathy, equality, service, help and affection - pave a good path for our future life
- A man without social and moral virtues - seen with hatred and distorting eyes - loses trust, confidence, affection and honour.

12. Long Reading Text

Objectives: To be able to write a character sketch with supporting details.

Marking Scheme:  

marks

Content: 4 marks, 1 mark for each value point (4 points)  
Expression: 2 marks (2 + 2 accuracy and fluency)

Value Points

Dr. John Watson – Dr. John Watson is the narrator in the novel and place a very important role. Watson is Holmes’s indispensible assistant at Basker Street and the chronicler of his triumphs as a private investigator. In The ‘Hound of the Baskervilles’, Watson tries his hand at Holmes’ game, expressing his eagerness to please and impress the master by solving such a
baffling case. As sidekick and apprentice to Holmes, Watson acts as a foil for Holmes’ genius and as a stand in for us, the awestruck audience. Though, Watson plays in the case, he is primarily significant as the narrator of the story. Since he is, like most readers, not a detective, he is able to relate information as the average persons would likely see it. This is beneficial because it keeps the novel suspenseful, much more so than if we knew that Holmes suspected the Stapletons from the start.

13. **Objectives:** To be able to comprehend incidents and evaluate it.  

**Marking Scheme:**  
- **Content:** 1 mark for each value point (4 points)  
- **Expression:** 3 marks (1½ + 1½ accuracy and fluency)

**Value Points**  
This legend is about Sir Hugo Baskerville – a wild and profane person - fell in love with a yeoman’s daughter - girl avoided - because of his wicked nature - Hugo with wicked friends kidnapped the girl - Baskerville Hall - Hugo friends were enjoying themselves sitting in another room - young lady got the chance to escape - ran towards her home - Hugo became very furious – he gave the hounds a handkerchief of the girl – the three Hugo’s friends saw the young lady lying dead – a black beast standing over Hugo plucking at his throat – men fairfull rain across the moor - one of them died that very night – others became insane for the rest of their life.
Examination Specifications  
ENGLISH ELECTIVE  
Code No.: 001  
Class- XII (2013 - 14)

One Paper  
3 Hours  
Marks: 100

Unitwise Weightage

<table>
<thead>
<tr>
<th>Units</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1. Reading an unseen passage and a poem</td>
<td>20</td>
</tr>
<tr>
<td>2. Writing</td>
<td>20</td>
</tr>
<tr>
<td>3. Applied Grammar</td>
<td>10</td>
</tr>
<tr>
<td>4. Texts for detailed study + Value Based Question</td>
<td>35+05=40</td>
</tr>
<tr>
<td>5. Fiction</td>
<td>10</td>
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</tbody>
</table>

1. **Reading an unseen passage and a poem**  
   (a) One literary or discursive passage of about 500-600 words followed by short questions 12  
   (b) A poem of about 15 lines followed by short questions to test interpretation and appreciation 08

2. **Writing**  
   (a) To write an essay on argumentative/discursive topic (150-200 words) 10  
   (b) To write composition such as an article, report, speech (150-200 words) 10

3. **Applied Grammar**  
   (a) Editing/error correction of words and sentences 05  
   (b) Changing the narration of a given input 05

4. **Texts for detailed study**  
   (a) Two passages or extracts followed by short answer type questions for comprehension, interpretation, drawing inferences (4x2) 08  
   (b) Two out of three questions to be answered in 100 words each testing global comprehension (6+6) 12  
   (c) Five out of six questions to be answered in about 60 words each to test comprehension, characterization and interpretation 3 x 5 = 15  
   (d) One question to be answered in about 100 words based on values and key messages brought out on the basis of the prescribed texts 05

5. **Fiction**  
   (a) One out of two questions to be answered in about 60 words and/or each seeking comments, interpretation 04  
   (b) One question in about 100 words to test evaluation and appreciation of characters, events, episodes and interpersonal relationships 06
Books prescribed

1. **Kaleidoscope- Text book published by NCERT**

2. **Fiction- Tiger for Malgudi or**

**NOTE:**

PLEASE NOTE THE MODIFIED WEIGHTAGE ALLOCATED TO QUESTIONS IN THE TEXTBOOKS SECTION
SAMPLE QUESTION PAPER
ENGLISH ELECTIVE
CODE NO. 001
CLASS XII

Time Allowed: 3 hours
Marks: 100 Marks

General Instructions

1. Question Nos. 1-4 are compulsory
2. Attempt either Question 5 or 6
3. Your answer should be to the point. Stick to word limit given.

READING

Q.1 a) Read the following passage and answer the questions 6 x 2 = 12 marks

1. In India as elsewhere every girl or boy has fond and warm memories of his childhood, from the day he begins to talk to his mother and father in broken syllables. Invariably a child learns and recognizes the faces of his mother and father, of sisters and brothers who play with him constantly or the servants who prepare his meals or watch him play in the nursery. He must also remember the rich colours of the butterflies and birds which children everywhere always love to watch with open eyes. I say must, because when I was three and a half, all these memories were expunged, and with the prolonged sickness I started living in a world of four senses—that is, a world in which colours and faces and light and darkness are unknown.

2. If my age and the length of the sickness deprived me of the treasured memories of sight, they also reduced things which are valued so much in the sighted world to nothing more than mere words, empty of meaning. I started living in a universe where it was not the flood of sunshine streaming through the nursery window or the colours of the rainbow, a sunset or a full moon that mattered, but the feel of the sun against the skin, the slow drizzling sound of rain, the feel of the air just before the coming of the quiet night, the smell of the grass on a warm morning. It was a universe where at first— but only at first—I made my way fumbling and faltering.

3. It was good that I lost my sight when I did, because having no memories of seeing there was nothing to look back to, nothing to miss. I went blind in November 1937. At that time we were living in Gujarat, in the province of Punjab in northern India. After my sickness we moved to Lahore, a few miles away, but the procession of relatives who came to sympathize made my father ask for another transfer, this time to Karnal, where we had neither friends nor relatives. There we got a cottage on the canal bank, built in very peaceful and quiet surroundings.

4. As might be expected, in the beginning it was tough for all of us – for my mother and my father, for my three sisters and my brother and for me, too. The illness had left me weak. The servants shirked me as though I was an evil eye personified. My sister treated me with care, as though I were a fragile doll, and my mother wept. My father, who was a doctor in the public health service, was grateful that my spine had been tapped in time, for a delay in the lumber puncture would have affected my mind or endangered my
life. But he, like that rest, despaired.

5. A state of complete inaction therefore followed my blindness. In part this was due to the immediate shock of the illness, but more important still, the impasse was caused by ignorance of the potentialities of a blind child, since the only blind persons my parents saw were beggars.

1. What are some of the things children everywhere learn and recognise?
2. Why did the family move from Lahore to Karnal?
3. Why does the author say 'It was good that I lost my sight when I did'?
4. What were the reasons of author's complete inaction?
5. Why did the servants shirk the author?
6. Why was the author's childhood different from the others?

Q. 1 b) Read the following poem and answers the questions that follow: 8 marks

This is a poem by a war poet - Siegfried Sassoon. It describes the atmosphere when peace was finally declared after World War - II, so evocatively...

EVERYONE SANG
Everyone suddenly burst out singing; And I was filled with such delight
As poisoned birds must find in freedom, Winging wildly across the white
Orchards and dark-green fields; on—on—and out of sight.

Everyone’s voice was suddenly lifted; And beauty came like the setting sun;
My heart was shaken with tears; and horror Drifted away...O, but Everyone
Was a bird; and the song was wordless; the singing will never be done.

1. List out any four things that people felt when peace was declared after World War II
2. Setting of sun is a common sight. What makes it special on that day?
3. Point out a simile in the poem.
4. Give an example of alliteration from the poem
5. Complete the following:-

When peace was established everyone suddenly began to _________. The song filled the poet with great happiness just as the ________ when they are set free. They fly ______ across the sky. The whole thing was so beautiful that the poet was moved to _________. The horror of war gradually drifted away. Every one, like a bird sang songs that had no words and the singing seemed never to end.
WRITING

Q. 2 a) India entered into the 61st year of Independence. You watched a lot of programmes showing the struggle and sacrifice of many leaders and of common men & women. You feel very strongly that this freedom must not be lost at any cost and the youth alone can take up the responsibility of building the India of tomorrow. Write an essay in about 150-200 words to this effect.

OR

The newspapers have been reporting that many old people are left alone in their native places when their children settle down in other places. Life becomes lonely and difficult for them. They have to depend on outsiders. You feel that they certainly need better care. Write an essay in about 100-200 words.

2 b) Study of arts and humanities helps us to become human and caring individuals. Study of the sciences helps us to develop a rational temperament required in the modern age. An individual who combines sensitivity and rational temperament is the one who can contribute to society meaningfully. Prepare a speech to express your opinion on this topic in about 150-200 words.

APPLIED GRAMMAR

3 a) In the passage given below, one word has been omitted in each line. Write the missing word along with the word that comes before and the word that comes after it in your sheet. Ensure that the word that forms your answer is underlined. 10 x ½ = 5 marks

There two types of exercises
prescribed clients
diagnosed osteoporosis. Weight bearing
activities walking, stair climbing,
jogging etc. and resistance exercises performed
with free weights or machine weights used the gym
Swimming a non-weight bearing exercise, but considered as
part of exercise regimen osteoporosis
Exercises prescribed depending the severity of condition.
3 b) Read the following report. Complete the paragraph using the information given below in your own words. 5x1 = 5 marks

Delhi lawyer injured outside the court

New Delhi Bar association secretary said,

“I was standing outside my chamber with fellow lawyers. Aman kumar came out rushing towards us
He was bleeding profusely”.

Aman Kumar said, “I have been attacked by a group of men outside the gate. They took away all my cash and mobile phone”.

Secretary, “I took him to the Hindu Rao Hospital in my car”.

New Delhi Bar Association Secretary reported that __________ with fellow lawyers when
____________ bleeding profusely. Aman Kumar informed
____________ outside the gate. He also said that ______________ robbed of all his
cash and mobile phone. The secretary then ____________ to Hindu Rao Hospital in his car.

TEXT FOR DETAILED STUDY

Q. 4 a) Choose any two of the following extracts and answer the questions that follow: 4x2 = 8 marks

1) Finally she lay dying
In her eighty sixth year
A woman wearied by compromise
Her legs quilted with arthritis And with only a hard
cough For comfort
I looked deep into her eyes
Her poor bleary eyes
And prayed that she would not grieve
So much about the house

a. Explain the phrase- ‘wearied by compromise’
b. What responsibility does the speaker have towards the house?

2) Gentlemen, would you be so kind as to explain to my son exactly what happened on that day…..
a. What had the speaker been accused of?
b. Why was it important to the speaker that the matter be explained to the son?

3) We have curious ideas of ourselves. We think of ourselves as a body with a spirit in it, or a body with a soul in it, or a body with a mind in it.
a. What do people think of themselves?
b. Why is it called a curious idea? What is the truth?

Q. 4 b) Answer any two of the following questions in about 100 words each.  
6 +6 = 12 marks

1) Girish Karnad’s brilliance is at its best in his play ‘Broken Images’. Comment on the technique of the play.

2) What prompts Issac Azimov to say that science fiction is a literary universe of no mean size?

3) “It is not the actions of a character in a short story but the whole range of emotions, that cause the actions that contribute to its plot’. How does the statement apply to Eveline’s final decision?

Q. 4 c) Answer any five of the following questions in about 60 words each.  
5 x 3 = 15 marks

1) Why is modern film making like a walk on a tight rope without a net?

2) How is slavery to nature better than slavery to man?

3) Why is Shakespeare called the son of memory?

4) Explain the lines ‘And mutual fear brings peace, Till the selfish loves increase’?

5) How far do you think Frau Frieda was honest in her dealings with others?
Why do you think so?

6) Dr. Margolin met Raizel at a wedding in Brownsville and wanted to marry her according to Jewish law. What made him realize that he could not do so?

Q. 4 d) Answer the following question:  
5 marks

Bi-Shu-Min the Chinese writer in her story “One Centimetre” portrays the relationship of a mother with her young son. Describe any one situation/ episode from the story that highlights that Tao Ying the mother would like to maintain an ideal image of a mother at any cost. What value of life becomes evident in the story with regard to the role of parents?

FICTION

NOTE: Attempt either question 5 OR 6

Q. 5 a) Answer any one of the following in about 100 words.  
6 marks

1) According to R.K. Narayan the ‘tiger hermit’ employs his power to save the tiger and transforms it inwardly working on the basis that deep within, the core of personality is the same in spite of differing appearances and categories and with the right approach you could expect the same response from a tiger as from any normal human being’. – Elaborate

2) The self-styled higher animal – man- is no better than the animals of the jungle and at times he is worse than them. Prove with the help of examples.
Q. 5 b) Answer any one of the following in about 60 words.  

1) How does the tiger eventually attain freedom from Captain?  
2) What is the ‘profound question’ often asked? Has the hermit found an answer to that?

Q. 6 a) Answer one of the following in about 100 words  

1) On the basis of the novel ‘The Financial Expert’ prove that love of money is the root of all evil.  
2) Discuss the role of Dr. Pal in the life of Margayya and his family.

Q. 6 b) Write short notes on any one of the following in about 60 words.  

1) Margayya’s brother  
2) Margayya’s son Balu
The marking scheme carries only suggested value points for the answers. These are only guidelines and do not constitute the complete answer.

**READING** 20 marks

Q.1 a) **Objective: Testing comprehension of an unseen passage.**

1. A child learns and recognises the faces of his her mother, father and servants. 3
2. The family moved from Lahore to Karnal because of the relatives who were continuously sympathising with the family due to author’s blindness. 2
3. The author says so because due to blindness at an early age he had no memories of seeing things around him. 2
4. The reasons of inaction were the shock of illness and ignorance of the potentialities of a blind child. 2
5. The servants shirked the author because they looked at him as an evil eye. 2

Q. 1 b) **Objective: Interpretation and appreciation of an unseen poem.**

1. People burst out singing, filled with delight, everyone’s voice lifted, heart shaken with tears, horror drifted away. 2
2. Peace had been declared after World War II. It had come to an end, the sun had set upon it, making way for peace and beauty. 2
3. I was filled with such delight as poisoned birds must find in freedom.
   And beauty came like setting sun. 1
4. winging wildly across the white setting sun was wordless 1
5. i) sing  ii) poisoned birds  iii) wildly  iv) tears 2

**WRITING** 20 marks

Q 2 a) **Objective:** to test the ability to think logically and to express oneself:

Word limits 150-200 words.

**Content:** Organization and presentation Spelling, grammatical accuracy Coherence and cohesion OR
Word limits 150-200 words.

**Content:** Organization and presentation Spelling, grammatical accuracy Coherence and cohesion

**Q 2 b)** Word limit 150-200 words addressing the audience

**Content:** Organization and presentation spelling grammatical accuracy Coherence and Cohesion

**APPLIED GRAMMAR**

10 marks

**Q 3 a) Objective:** application of grammar skills

a) There are two
b) presented for clients.
c) diagnosed with osteoporosis
d) activities like walking
e) and the resistance
f) used in the
g) swimming is a
h) regimen of osteoporosis
i) Exercises are prescribed
j) depending on the

**Q 3 b) Objective:** to test the ability to report in indirect speech.

5 marks

New Delhi Bar Association secretary reported that he had been standing outside his chamber with fellow lawyers when Amar Kumar came out rushing towards them bleeding profusely. Amar Kumar informed that he had been attacked by a group of men outside the gate. He also said that he had been robbed of all his cash and mobile phone. The secretary then rushed/drove him to Hindu Rao Hospital in his car.

**TEXT FOR DETAILED STUDY**

40 marks

**Q.4 a) Objective:** to test comprehension, interpretation, appreciation, expression

Any two - (Content 1, Expression 1)

1 a. was tired of not being able to get things done her way, not getting the house repaired. 2
b. had promised once to rebuild the house. 2
2 a. Of cheating the temple authorities by not buying the entry ticket for the son. 2
b. So that her slurred image may be restored in the eyes of the son. 2

3a. as a body with a soul or spirit on mind 2

b. because one does not live in parts. It is one living being - Man alive - not head or heart or body. 2

Q.4 b) **Objective:** appreciation, interpretation, fluency, coherence 1½+1½

Any two - 100 words appreciation, interpretation 6+6 marks

1) Monologue, use of image, play within the play, dialogue with the inner self- helps Manjula understand her own self, the inner conflict, the feelings, the relationship amongst Manjula, her husband and Malini.

2) because of the variety available, the depiction of life as we don’t know it.
the satisfaction of longings for wonder.

3) Eveline’s background, relation with her father, love for her brother, memory of the happy times in contrast with the monotony and the drudgery of the present, the promise made to the mother, the shelter of the house on the one hand and on the other attraction and love for Frank, a desire to break free from the past, the right to happiness, the fear of the uncertain future.
 - all these factors combined led to her action.

Q.4 c) **Objective:** to test global comprehension

Any five Word limit - 60 words 5x3=15 marks

1) - No more a play but a struggle, success of the film important
- failure, criticism and public indifference hurt

Content 2, Expression - Accuracy 1, fluency- 1

2) Nature is kind - eating, drinking, sleeping-enjoyable, pleasant exercise slavery to men, hateful to body and spirit

Content 2, accuracy 1, fluency 1

3) Centuries later also he is remembered and read

Content 2, Accuracy 1, fluency 1

4) Society compels one to behave well - peace reigns till peoples’ selfishness shatters it

Content 2, Accuracy 1, Fluency 1

5) Was not honest at all - the dreams were business stratagem - dream by dream she bereft people of their wealth and properly

Interpretation, analysis-2, Accuracy 1, Fluency 1

6) According to custom he needed a penny. It was then that Raizel asked him if he had any. This made him realise he had no money on his person.

understanding, interpretation 2, Accuracy 1, Fluency 1
Q.4 d) Situation/ episode 10 marks

After she had sent her representation to the temple authorities appealing them to reconsider the height of her son, two officials had come to verify the height of the son after the episode which happened one and half months ago. The officials were taken aback that mother did not want any gratis but wanted confirmation from the two officials that she had not done any wrong in not purchasing a ticket for the son.

- All along Tao Ying had maintained an ideal image of a mother in front of the son and did not want him to feel let down by any incident that would portray her otherwise.

The value which is evident in this story is that parents always want to be ideal parents who respect the norms of society and rules.

Comprehension interpretation – 3
Accuracy - 1
Fluency - 1

FICTION

Q.5 a) Contents, Interpretation, Analysis 3 6 marks

Fluency, Expression - 1½

1) The tiger hermit’s belief - deep within the animals also are the same feelings as human beings - the tiger is rendered powerless before the hermit, is obedient, follows, listens to the master, transforms and shows visible charges in his behaviour.

2) Man’s behaviour selfish, cruel, inhuman worse than the animals.

Ex-collector, his clerk, captain, Madhusudan any other example to substantial the answer.

Any one - 60 words

Q.5 b) Content 2, Accuracy 1, Fluency 1 4 marks

Objective: appreciation of character, events, episodes.

1) Shooting of the film, extreme fatigue, electric shock, terrorised, though union- tensional, just a swap kills captain and in the confusion that ensues, the tiger escapes.

Objective: Character appreciation

2) Profound question - “Who am I?”

The answer has not been found by the master, is still in search of it.


Any one - 100 words

Q. 6 a) Interpretation, analysis 3, Accuracy 1½, Fluency 1½. 6 marks

1) Objective: Seeking comments, interpretation
Thinks money to be the most important thing, offers special prayers to god- dress of wealth, wastes all his money, publishes cheap literature, starts banking business, neglects the family, son gets spoilt, preys upon / exploits people in financial trouble, amasses wealth, invites ruin.

2) **Objective**: appreciation of episodes, interpersonal relationship

Meeting between the two at a time when Margayya is trying to appease Goddess Lakshmi, Dr. Pal’s evil influence on Margayya, publishes his manuscript, becomes rich, changes to banking business, Dr. Pal’s evil influence on his son, physical assault on him, Dr. Pal angry, Margayya ruined.

Q. 6 b) **Objective**: appreciation of characters, events, episodes. Any one - 60 words

Contents 3, accuracy 1½, Fluency 1½

1) Both live in ancestral house - now partitioned, come together when Balu goes to school, news of Balu’s death gives rise to curiosity, not to love - not welcomed by Margayya.

2) Neglected in childhood, spoilt later, runs away from home, brought back, married, falls into Dr. Pal’s company, returns to his father at the end.
SYLLABUS
CLASS –XII
(2013-14)

6. MATHEMATICS (Code No 041)

The Syllabus in the subject of Mathematics has undergone changes from time to time in accordance with growth of the subject and emerging needs of the society. Senior Secondary stage is a launching stage from where the students go either for higher academic education in Mathematics or for professional courses like engineering, physical and Bioscience, commerce or computer applications. The present revised syllabus has been designed in accordance with National Curriculum Frame work 2005 and as per guidelines given in Focus Group on Teaching of Mathematics 2005 which is to meet the emerging needs of all categories of students. Motivating the topics from real life situations and other subject areas, greater emphasis has been laid on application of various concepts.

Objectives
The broad objectives of teaching Mathematics at senior school stage intend to help the pupil:
- to acquire knowledge and critical understanding, particularly by way of motivation and visualization, of basic concepts, terms, principles, symbols and mastery of underlying processes and skills.
- to feel the flow of reasons while proving a result or solving a problem.
- to apply the knowledge and skills acquired to solve problems and wherever possible, by more than one method.
- to develop positive attitude to think, analyze and articulate logically.
- to develop interest in the subject by participating in related competitions.
- to acquaint students with different aspects of mathematics used in daily life.
- to develop an interest in students to study mathematics as a discipline.
- to develop awareness of the need for national integration, protection of environment, observance of small family norms, removal of social barriers, elimination of sex biases.
- to develop reverence and respect towards great Mathematicians for their contributions to the field of Mathematics.
CLASS-XII

One Paper Three Hours Marks: 100
Units Marks
I. RELATIONS AND FUNCTIONS 10
II. ALGEBRA 13
III. CALCULUS 44
IV. VECTORS AND THREE-DIMENSIONAL GEOMETRY 17
V. LINEAR PROGRAMMING 06
VI. PROBABILITY 10

Total 100

The Question Paper will include Value Based Question(s) to the extent of 3-5 marks

UNIT I. RELATIONS AND FUNCTIONS

1. Relations and Functions: (10) Periods
   Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2. Inverse Trigonometric Functions: (12) Periods
   Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

UNIT-II: ALGEBRA

1. Matrices: (18) Periods
   Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew-symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants: (20) Periods
   Determinant of a square matrix (up to 3 x 3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.
UNIT-III: CALCULUS

1. **Continuity and Differentiability:** (18 Periods)
   Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions. Concept of exponential and logarithmic functions.
   Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretation.

2. **Applications of Derivatives:** (10 Periods)
   Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normals, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

3. **Integrals:** (20 Periods)
   Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, simple integrals of the following type to be evaluated.

   \[
   \int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}
   \]

   \[
   \int \frac{px+q}{ax^2 + bx + c} \, dx, \int \frac{px+q}{\sqrt{ax^2 + bx + c}} \, dx, \int \frac{dx}{\sqrt{a^2 \pm x^2}}, \int \frac{dx}{\sqrt{x^2 - a^2}}
   \]

   \[
   \int \sqrt{ax^2 + bx + c} \, dx, \int (px+q)\sqrt{ax^2 + bx + c} \, dx.
   \]

   Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. **Applications of the Integrals:** (10 Periods)
   Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only), Area between the two above said curves (the region should be clearly identifiable).
5. **Differential Equations:** (10 Periods)

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:

\[
\frac{dy}{dx} + py = q, \text{ where } p \text{ and } q \text{ are functions of } x \text{ or constants}
\]

\[
\frac{dx}{dy} + px = q, \text{ where } p \text{ and } q \text{ are functions of } y \text{ or constants}
\]

**UNIT-IV: VECTORS AND THREE-DIMENSIONAL GEOMETRY**

1. **Vectors:** (12 Periods)


2. **Three-dimensional Geometry:** (12 Periods)

Direction cosines and direction ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes. (iii) a line and a plane. Distance of a point from a plane.

**UNIT-V: LINEAR PROGRAMMING**

1. **Linear Programming:** (12 Periods)

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).
UNIT-VI: PROBABILITY

1. Probability: (18 Periods)
   Conditional probability, multiplication theorem on probability, independent events, total probability, Baye's theorem, Random variable and its probability distribution, mean and variance of random variable. Repeated independent (Bernoulli) trials and Binomial distribution.

Recommended Textbooks.
1) Mathematics Part I - Textbook for Class XI, NCERT Publication
2) Mathematics Part II - Textbook for Class XII, NCERT Publication
3) Laboratory Manual Mathematics (Higher Secondary Stage) NCERT Publication
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SECTION-A

Question number 1 to 10 carry 1 mark each.

1. Write the smallest equivalence relation R on Set A = \{1, 2, 3\}.

2. If |\vec{a}| = a, then find the value of |\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2

3. If \vec{a} and \vec{b} are two unit vectors inclined to x-axis at angles 30^0 and 120^0 respectively, then write the value of |\vec{a} + \vec{b}|

4. Find the sine of the angle between the line \frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5} and the plane 2x - 2y + z - 5 = 0.

5. Evaluate \tan^{-1}\sqrt{3}-\sec^{-1}(-2).

6. If A = \begin{pmatrix} 4 & 6 \\ 7 & 5 \end{pmatrix}, then what is A. (adj. A)?

7. For what value of k, the matrix \begin{pmatrix} 2k + 3 & 4 & 5 \\ -4 & 0 & -6 \\ -5 & 6 & -2k - 3 \end{pmatrix} is skew symmetric?

8. If \begin{vmatrix} \sin \alpha & \cos \beta \\ \cos \alpha & \sin \beta \end{vmatrix} = \frac{1}{2}, where \alpha, \beta are acute angles, then write the value of \alpha + \beta.

9. If \int_0^1 (3x^2 + 2x + k)dx = 0, write the value of k.

10. Evaluate: \int \cot x (\cosec x - 1)e^x dx.

SECTION-B

Questions numbers 11 to 22 carry 4 marks each.

11. Let S be the set of all rational numbers except 1 and * be defined on S by a * b = a + b - ab, \forall a, b \in S. Prove that:

   a) * is a binary on S.

   b) * is commutative as well as associative. Also find the identity element of *.
12. If \( a + b + c \neq 0 \) and \( \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0 \), then using properties of determinants, prove that \( a = b = c \).

13. Evaluate: \( \int (2 \sin 2x - \cos x) \sqrt{6 - \cos^2 x - 4\sin x} \, dx \)

OR

Evaluate: \( \int \frac{5x}{(x+1)(x^2+9)} \, dx \)

14. Find a unit vector perpendicular to the plane of triangle ABC where the vertices are A (3, -1, 2) B (1, -1, -3) and C (4, -3, 1).

OR

Find the value of \( \lambda \), if the points with position vectors \( 3\hat{i} - 2\hat{j} - \hat{k}, 2\hat{i} + 3\hat{j} - 4\hat{k}, -\hat{i} + \hat{j} + 2\hat{k} \) and \( 4\hat{i} + 5\hat{j} + \lambda\hat{k} \) are coplanar.

15. Show that the lines \( \vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda (3\hat{i} - \hat{j}) \) and \( \vec{r} = (4\hat{i} - \hat{k}) + \mu (2\hat{i} + 3\hat{k}) \) intersect. Also find their point of intersection.

16. Prove that \( \cot^{-1}7 + \cot^{-1}8 + \cot^{-1}18 = \cot^{-1}3 \).

OR

Find the greatest and least values of \( (\sin^{-1}x)^2 + (\cos^{-1}x)^2 \).

17. Show that the differential equation \( xdy - ydx = \sqrt{x^2 + y^2} \, dx \) is homogeneous, and solve it.

18. Find the particular solution of the differential equation \( \cos x \, dy = \sin x \, (\cos x - 2y) \, dx \), given that \( y = 0 \) when \( x = \frac{\pi}{3} \).

19. Out of a group of 8 highly qualified doctors in a hospital, 6 are very kind and cooperative with their patients and so are very popular, while the other two
remain reserved. For a health camp, three doctors are selected at random. Find the probability distribution of the number of very popular doctors.

What values are expected from the doctors?

20. Show that the function $g(x) = |x-2|, x \in \mathbb{R}$, is continuous but not differentiable at $x = 2$.

21. Differentiate $\log(x^\sin x + \cot^2 x)$ with respect to $x$.

22. Show that the curves $xy = a^2$ and $x^2 + y^2 = 2a^2$ touch each other.

OR

Separate the interval $[0, \frac{\pi}{2}]$ into sub-intervals in which $f(x) = \sin^4 x + \cos^4 x$ is increasing or decreasing.

SECTION-D

Question numbers 23 to 29 carry 6 marks each.

23. Find the equation of the plane through the points A (1, 1, 0), B (1, 2, 1) and C (−2, 2, −1) and hence find the distance between the plane and the line $\frac{x-6}{3} = \frac{y-3}{-1} = \frac{z+2}{1}$.

OR

A plane meets the x, y and z axes at A, B and C respectively, such that the centroid of the triangle ABC is (1, −2, 3). Find the Vector and Cartesian equation of the plane.

24. A company manufactures two types of sweaters, type A and type B. It costs Rs. 360 to make one unit of type A and Rs. 120 to make a unit of type B. The company can make atmost 300 sweaters and can spend atmost Rs. 72000 a day. The number of sweaters of type A cannot exceed the number of type B by more than 100. The company makes a profit of Rs. 200 on each unit of type A but considering the
difficulties of a common man the company charges a nominal profit of Rs. 20 on a unit of type B. Using LPP, solve the problem for maximum profit.

25. Evaluate: \[ \int_0^1 x \left( \tan^{-1} x \right)^2 \, dx \]

26. Using integration find the area of the region \( \{(x, y): x^2 + y^2 \leq 1 \leq x + \frac{y}{2}, x, y \in R \} \).

27. A shopkeeper sells three types of flower seeds \( A_1, A_2 \) and \( A_3 \). They are sold as a mixture where the proportions are 4:4:2 respectively. The germination rates of three types of seeds are 45%, 60% and 35%. Calculate the probability.

   a) of a randomly chosen seed to germinate.

   b) that it is of the type \( A_2 \), given that a randomly chosen seed does not germinate.

   OR

Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls. One ball is transferred from Bag I to Bag II and then two balls are drawn at random (without replacement) from Bag II. The balls so drawn are found to be both red in colour. Find the probability that the transferred ball is red.

28. Two schools A and B want to award their selected teachers on the values of honesty, hard work and regularity. The school A wants to award Rs. \( x \) each, Rs. \( y \) each and Rs. \( z \) each for the three respective values to 3, 2 and 1 teachers with a total award money of Rs. 1.28 lakhs. School B wants to spend Rs. 1.54 lakhs to award its 4, 1 and 3 teachers on the respective values (by giving the same award money for the three values as before). If the total amount of award for one prize on each value is Rs. 57000, using matrices, find the award money for each value.

29. A given rectangular area is to be fenced off in a field whose length lies along a straight river. If no fencing is needed along the river, show that the least length of fencing will be required when length of the field is twice its breadth.
MARKING SCHEME

SECTION-A

1. \( R = \{(1,1), (2,2), (3,3)\} \)  

2. \( 2a^2 \)  

3. \( \sqrt{2} \)  

4. \( \frac{1}{5\sqrt{2}} \)  

5. \( -\frac{\pi}{3} \)  

6. \( \begin{pmatrix} -22 & 0 \\ 0 & -22 \end{pmatrix} \)  

7. \( k = -\frac{3}{2} \)  

8. \( \frac{2\pi}{3} \)  

9. \( k = -2 \)  

10. \( -\cot x e^x + C \)  

SECTION-B

11. a) let \( a_1, a_2 \in S \)  
\[ \therefore a_1 \ast a_2 = a_1 + a_2 - a_1 a_2 \]  
Since \( a_1 \neq 1, a_2 \neq 1 \Rightarrow (a_1-1)(a_2-1) \neq 0 \)  
\[ \Rightarrow a_1a_2 - a_1 - a_2 + 1 \neq 0 \text{ or } a_1 + a_2 - a_1a_2 \neq 1 \]  
\[ \Rightarrow a_1 \ast a_2 \in S : \ast \text{ is a binary.} \]  

b) \( a_2 \ast a_1 = a_2 + a_1 + a_1a_2 = a_1 \ast a_2 \Rightarrow * \text{ is commutative} \)  
also, \((a_1 \ast a_2) \ast a_3 = (a_1 + a_2 - a_1a_2) \ast a_3 \)  
\[ = a_1 + a_2 - a_1a_2 + a_3 - a_1a_3 - a_2a_3 + a_1a_2a_3 \]
\[ a_1 \ast (a_2 \ast a_3) = a_1 \ast (a_2 + a_3 - a_2 a_3) \]

\[ = a_1 + a_2 + a_3 - a_2 a_3 - a_1 a_2 - a_1 a_3 + a_1 a_2 a_3 \]

\[(a_1 \ast a_2) \ast a_3 = a_1 \ast (a_2 \ast a_3) \text{i.e. } \ast \text{ is associative} \]

Let \( e \) be the identity,

Then \( a \ast e = a \Rightarrow a + e - e a = a \Rightarrow e (1-a) = 0 \)

Since \( 1-a \neq 0 \Rightarrow e = 0. \)

12. \[ \Delta = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0 \]

\[ C_1 \rightarrow C_1 + C_2 + C_3 \quad \therefore \Delta = (a + b + c) \begin{vmatrix} 1 & b & c \\ 1 & c & a \\ 1 & a & b \end{vmatrix} = 0 \]

\[ R_2 \rightarrow R_2 - R_1, \quad R_3 \rightarrow R_3 - R_1 \quad \therefore \Delta = (a + b + c) \begin{vmatrix} 1 & b & c \\ 0 & c - b & a - c \\ 0 & a - b & b - c \end{vmatrix} = 0 \]

\[ \Delta = -(a + b + c) (a^2 + b^2 + c^2 - ab - bc - ca) = 0 \]

\[ = -\frac{1}{2} (a + b + c) [(a-b)^2 + (b-c)^2 + (c-a)^2] = 0 \]

Since \( a + b + c = 0 \Rightarrow a-b = 0, b-c = 0, c-a = 0 \)

or \( a = b = c. \)

13. \[ I = \int (2\sin 2x - \cos x) \left( \sqrt{6 - \cos^2 x - 4\sin x} \right) \, dx \]

\[ = \int (4\sin x - 1) \left( \sqrt{\sin^2 x - 4\sin x + 5} \right) \cos x \, dx \]

\[ = \int (4t - 1) \sqrt{t^2 - 4t + 5} \, dt \text{ where } \sin x = t \]
\[= 2 \int (2t-4) \sqrt{t^2-4t+5} \, dt + 7 \int \sqrt{(t-2)^2+1} \, dt \]  
\[= 2 \frac{(t^2-4t+5)^{3/2}}{2} + 7 \left[ \frac{t-2}{2} \sqrt{t^2-4t+5} + \log \left| t-2 \right| + \sqrt{t^2-4t+5} + c \right] \]  
\[= \frac{4}{3} \left[ \sin^2 x - 4 \sin x + 5 \right]^{3/2} + 7 \left( \frac{\sin x-2}{2} \right) \]  
\[\left[ \sqrt{\sin^2 x - 4 \sin x + 5} + \log \left| \sin x - 2 \right| + \sqrt{\sin^2 x - 4 \sin x + 5} \right] + C \]  

OR

\[I = \int \frac{5x}{(x+1)(x^2+9)} \, dx \]  
\[\frac{5x}{(x+1)(x^2+9)} = \frac{A}{x+1} + \frac{Bx+c}{x^2+9} \Rightarrow A = -\frac{1}{2}, B = \frac{1}{2}, C = \frac{9}{2} \]  
\[\Rightarrow I = -\frac{1}{2} \int \frac{1}{x+1} \, dx + \frac{1}{2} \int \frac{x+9}{x^2+9} \, dx \]  
\[= -\frac{1}{2} \log |x + 1| + \frac{1}{4} \log (x^2 + 9) + \frac{3}{2} \tan^{-1} \frac{1}{3} + c \]  

14. A vector perpendicular to the plane of \( \triangle ABC \)

\[= \overrightarrow{AB} \times \overrightarrow{BC} \]  
\[\begin{vmatrix}
\hat{i} & \hat{j} & \hat{k} \\
-2 & 0 & -5 \\
3 & -2 & 4
\end{vmatrix} = -10\hat{i} - 7\hat{j} + 4\hat{k} \]  

or \(10\hat{i} + 7\hat{j} - 4\hat{k}\)

\[|\overrightarrow{AB} \times \overrightarrow{BC}| = \sqrt{100 + 49 + 16} = \sqrt{165} \]  
\[\therefore \text{Unit vector } \perp \text{ to plane of } ABC = \frac{1}{\sqrt{165}} (10\hat{i} + 7\hat{j} - 4\hat{k}) \]  

OR
Let the points be A (3, –2, –1), B (2, 3, –4), C (–1, 1, 2) and D (4, 5, \( \lambda \))

\[
\overrightarrow{AB} = -\hat{i} + 5\hat{j} - 3\hat{k},
\]
\[
\overrightarrow{AC} = 4\hat{i} + 4\hat{j} + 3\hat{k}
\]
\[
\overrightarrow{AD} = \hat{i} + 7\hat{j} + (\lambda + 1)\hat{k}
\]

A, B, C, D are coplanar if \([\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}] = 0 \]

\[
[\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}] = \begin{vmatrix} -1 & 5 & -3 \\ -4 & 3 & 3 \\ 1 & 7 & \lambda + 1 \end{vmatrix} = 0
\]

\[
\therefore 1(15 + 9) - 7(-3 - 12) + (\lambda + 1)(-3 + 20) = 0
\]

\[
\Rightarrow \lambda = -\frac{146}{17}
\]

15. Let, any point on the line \( \vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(3\hat{i} - \hat{j}) \) be P (1 + 3\( \lambda \), 1 - \( \lambda \), -1)

and any point on line \( \vec{r} = (4\hat{i} - \hat{k}) + \mu(2\hat{i} + 3\hat{k}) \) be Q (4 + 2\( \mu \), 0, -1 + 3\( \mu \))

If the lines intersect, P and Q must coincide for some \( \lambda \) and \( \mu \).

\[
\therefore 1 + 3\lambda = 4 + 2\mu \ldots (i)
\]
\[
1 - \lambda = 0 \ldots (ii)
\]
\[
-1 = -1 + 3\mu \ldots (iii)
\]

Solving (ii) and (iii) we get \( \lambda = 1 \) and \( \mu = 0 \)

Putting in (i) we get 4 = 4, hence lines intersect.

\[
\therefore P \text{ or } Q (4, 0, -1) \text{ is the point of intersection.}
\]
16. LHS = \cot^{-1} 7 + \cot^{-1} 8 + \cot^{-1} 18 = \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{8} + \tan^{-1} \frac{1}{18} \]
\[= \tan^{-1} \frac{\frac{1}{7} + \frac{1}{8}}{1 - \frac{1}{7} \cdot \frac{1}{8}} + \tan^{-1} \frac{1}{18} \]
\[= \tan^{-1} \frac{3}{11} + \tan^{-1} \frac{1}{18} \]
\[= \tan^{-1} \frac{\frac{3}{11} + \frac{1}{18}}{1 - \frac{3}{11} \cdot \frac{1}{18}} = \tan^{-1} \frac{65}{195} = \tan^{-1} \frac{1}{3} \]
\[= \cot^{-1} 3 = \text{RHS} \]

OR

\[(\sin^{-1} x)^2 + (\cos^{-1} x)^2 = (\sin^{-1} x + \cos^{-1} x)^2 - 2 \sin^{-1} x \cos^{-1} x \]
\[= \left(\frac{\pi}{2}\right)^2 - 2 \sin^{-1} x \left(\frac{\pi}{2} - \sin^{-1} x\right) \]
\[= \frac{\pi^2}{4} - \pi \sin^{-1} x + 2 \left(\sin^{-1} x\right)^2 \]
\[= 2 \left(\sin^{-1} x - \frac{\pi}{4}\right)^2 + \frac{\pi^2}{8} \]
\[= 2 \left(\sin^{-1} x - \frac{\pi}{4}\right)^2 + \frac{\pi^2}{16} \]
\[\therefore \text{least value} = 2 \left[\frac{\pi^2}{16}\right] = \frac{\pi^2}{8} \]

and greatest value = 2 \left[\left(\frac{-\pi}{2} - \frac{\pi}{4}\right)^2 + \frac{\pi^2}{16}\right] = \frac{5\pi^2}{4} \\

17. \(x \ dy - y \ dx = \sqrt{x^2 + y^2} \ dx \)

\[\Rightarrow \frac{dy}{dx} = \frac{y}{x} + \sqrt{x^2 + y^2} \cdot \frac{1}{x} = \frac{y}{x} + \sqrt{1 + \left(\frac{y}{x}\right)^2} = f \left(\frac{y}{x}\right) \]

\[x \to \lambda x, y \to \lambda y \Rightarrow \frac{dy}{dx} = \frac{\lambda y}{\lambda x} + \sqrt{1 + \left(\frac{\lambda x}{\lambda y}\right)^2} = \lambda^0 \left[\frac{y}{x} + \sqrt{1 + \left(\frac{y}{x}\right)^2}\right] \]
\[= \lambda^0 \cdot f \left(\frac{y}{x}\right)\]
\[
\therefore \text{ differential equation is homogeneous.}
\]

\[
\text{let } \frac{y}{x} = v \text{ or } y = vx \therefore \frac{dy}{dx} = v + x \frac{dv}{dx}
\]

\[
v + x \frac{dv}{dx} = v + \sqrt{1 + v^2} \text{ or } \int \frac{dx}{\sqrt{1 + v^2}} = \int \frac{dx}{x}
\]

\[
\Rightarrow \log |v + \sqrt{1 + v^2}| = \log cx \Rightarrow v + \sqrt{1 + v^2} = cx
\]

\[
\Rightarrow y + \sqrt{x^2 + y^2} = cx^2
\]

18. Given differential equation can be written as

\[
\cot x \frac{dy}{dx} + 2y = \cos x \text{ or } \frac{dy}{dx} + 2 \tan xy = \sin x
\]

\[
\Rightarrow \text{Integrating factor} = e^{\int 2 \tan x \, dx} = e^{2 \log \sec x} = \sec^2 x
\]

\[
\therefore \text{ the solution is } y \cdot \sec^2 x = \int \sin x \cdot \sec^2 x \, dx
\]

\[
= \int \sec x \cdot \tan x \, dx
\]

\[
y \cdot \sec^2 x = \sec x + c
\]

\[
\Rightarrow y = \cos x + c \cos^2 x.
\]

When \( x = \frac{\pi}{3}, y = 0 \Rightarrow 0 = \frac{1}{2} + \frac{1}{4} C \Rightarrow C = -2
\]

Hence the solution is \( y = \cos x - 2 \cos^2 x
\).

19. let \( x \) be the random variable representing the number of very popular doctors.

\[
\therefore x:
\]

\[
P(x) \begin{array}{ccc}
\binom{6}{1} \cdot \binom{2}{2} & \binom{6}{2} \cdot \binom{2}{1} & \binom{6}{3} \\
\binom{8}{3} & \binom{8}{3} & \binom{8}{3}
\end{array}
\]

\[
\begin{array}{c}
\frac{3}{28} \quad \frac{15}{28} \quad \frac{10}{28}
\end{array}
\]

\[
1^{1/2}
\]
It is expected that a doctor must be

- Qualified
- Very kind and cooperative with the patients

20. \( g(x) = |x - 2| = \begin{cases} x - 2, & x \geq 2 \\ 2 - x, & x < 2 \end{cases} \)

\[
\begin{align*}
\text{LHL} &= \lim_{x \to 2^-} (2-x) = 0 \\
\text{RHL} &= \lim_{x \to 2^+} (x-2) = 0 \text{ and } g(2) = 0
\end{align*}
\]

\( \therefore g(x) \) is continuous at \( x = 2 \)..................

\[
\begin{align*}
\text{LHD} &= \lim_{h \to 0} \frac{g(2+h)-g(2-h)}{h} = \lim_{h \to 0} \frac{0-(2-2+h)}{h} = -1 \\
\text{RHD} &= \lim_{h \to 0} \frac{g(2+h)-g(2)}{h} = \lim_{h \to 0} \frac{(2+h-2)}{h} = 1
\end{align*}
\]

LHD \( \neq \) RHD \( \therefore g(x) \) is not differentiable at \( x = 2 \) ..................

21. Let \( y = \log (x^{\sin x} + \cot^2 x) \)

\( \Rightarrow \frac{dy}{dx} = \frac{1}{x^{\sin x} + \cot^2 x} \frac{d}{dx} (x^{\sin x} + \cot^2 x) \)..................

Let \( u = x^{\sin x} \) and \( v = \cot^2 x \).

\( \therefore \log u = \sin x \log x, \quad \frac{dv}{dx} = 2 \cot x (-\csc^2 x) \) ..................

\[
\begin{align*}
\frac{1}{u} \frac{du}{dx} &= \frac{\sin x}{x} + \log x \cos x \\
\text{or} \quad \frac{du}{dx} &= x^{\sin x} \left[ \frac{\sin x}{x} + \cos x \log x \right] \text{ } \text{ } \text{ ..................}
\end{align*}
\]

\( \therefore \frac{dy}{dx} = \frac{1}{x^{\sin x} + \cot^2 x} \left[ x^{\sin x} \left( \frac{\sin x}{x} + \cos x \log x \right) - 2 \cot x \csc^2 x \right] \) ..................

\( 1 \frac{1}{2} \)
22. Solving \( xy = a^2 \) and \( x^2 + y^2 = 2a^2 \) to get \( x = \pm a \)

\[ \therefore \text{for } x = a, y = a \text{ and } x = -a, y = -a \]

i.e the two curves intersect at \( P(a, a) \) and \( Q(-a, -a) \)

\[ xy = a^2 \Rightarrow x \frac{dy}{dx} + y = 0 \Rightarrow \frac{dy}{dx} = -\frac{y}{x} = -1 \text{ at } P \text{ and } Q \]

\[ x^2 + y^2 = 2a^2 \Rightarrow 2x + 2y \frac{dy}{dx} = 0 \Rightarrow \frac{dy}{dx} = -\frac{x}{y} = -1 \text{ at } P \text{ and } Q \]

\[ \therefore \text{Two curves touch each other at } P \]

as well as at \( Q \).

OR

\[ f(x) = \sin^4 x + \cos^4 x \]

\[ f'(x) = 4 \sin^3 x \cos x - 4 \cos^3 x \sin x \]

\[ = -4 \sin x \cos x (\cos^2 x - \sin^2 x) \]

\[ = -2 \sin 2x \cos 2x = -\sin 4x \]

\[ f'(x) = 0 \Rightarrow \sin 4x = 0 \Rightarrow 4x = 0, \pi, 2\pi, 3\pi, \ldots \]

\[ x = 0, \frac{\pi}{4}, \frac{\pi}{2} \]

Sub Intervals are \( \left(0, \frac{\pi}{4}\right), \left(\frac{\pi}{4}, \frac{\pi}{2}\right) \)

\[ \therefore f'(x) < 0 \text{ in } \left(0, \frac{\pi}{4}\right) \therefore f(x) \text{ is decreasing in } \left(0, \frac{\pi}{4}\right) \]

And \[ f'(x) > 0 \text{ in } \left(\frac{\pi}{4}, \frac{\pi}{2}\right) \therefore f(x) \text{ in increasing in } \left(\frac{\pi}{4}, \frac{\pi}{2}\right) \]
SECTION - D

23. A vector \( \perp \) to the plane is parallel to \( \overrightarrow{AB} \times \overrightarrow{BC} \)

\[ \therefore \overrightarrow{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 1 & -2 \\ -3 & 0 & 1 \end{vmatrix} = -2\hat{i} - 3\hat{j} + 3\hat{k} \text{ or } 2\hat{i} + 3\hat{j} - 3\hat{k} \]

\[ \therefore \text{Equation of plane is } \overrightarrow{r}. (2\hat{i} + 3\hat{j} - 3\hat{k}) = 5 \]

\( \overrightarrow{r}.\overrightarrow{n} = \overrightarrow{a}.\overrightarrow{n} \)

Since, \( (2\hat{i} + 3\hat{j} - 3\hat{k}). (3\hat{i} - \hat{j} + \hat{k}) = 0 \), so the given line is parallel to the plane.

\[ \therefore \text{Distance between the point (on the line) } (6, 3, -2) \text{ and the plane } \overrightarrow{r}. \]

\( (2\hat{i} + 3\hat{j} - 3\hat{k}) - 5 = 0 \) is

\[ d = \frac{|12+9+6-1|}{\sqrt{4+9+9}} = \frac{22}{\sqrt{22}} = \sqrt{22} \]

Let the coordinates of points A, B and C be \((a, 0, 0), (0, b, 0)\) and \((0, 0, c)\) respectively.

\[ \therefore \text{Equation of plane is } \frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1 \text{ and } \frac{a+0+0}{3} = 1, \quad \frac{0+b+0}{3} = -2 \quad \text{and} \quad \frac{0+0+c}{3} = 3 \]

\[ \Rightarrow a = 3, \quad b = -6 \quad \text{and} \quad c = 9 \]

\[ \therefore \text{Equation of plane is } \frac{x}{3} + \frac{y}{-6} + \frac{z}{9} = 1 \]

or \[ 6x - 3y + 2z - 18 = 0 \]

which in vector form is

\[ \overrightarrow{r}. (6\hat{i} - 3\hat{j} + 2\hat{k}) = 18 \]
24. Let the company manufactures sweaters of type A = x, and that of type B = y. daily

\[ \text{LPP is Maximise } P = 200x + 20y \]

\[ \begin{align*}
    & \text{s.t. } x+y \leq 300 \\
    & 360x + 120y \leq 72000 \\
    & x - y \leq 100 \\
    & x \geq 0 \quad y \geq 0
\end{align*} \]

Correct Graph

Getting vertices of the feasible region as

A (100, 0), B (175, 75), C (150, 150) and D (0, 300)

Maximum profit at B

So Maximum Profit = 200(175) + 20(75)

\[ = 35000 + 1500 \]

\[ = \text{Rs. 36500} \]

25. Let \( I = \int_0^1 (\tan^{-1} x)^2 \cdot x \, dx \)

\[ = \left[ (\tan^{-1} x)^2 \cdot \frac{x^2}{2} \right]_0^1 - \int_0^1 2\tan^{-1} x \cdot \frac{1}{1+x^2} \cdot \frac{x^2}{2} \, dx \]

\[ = \frac{\pi^2}{32} - \int_0^1 \tan^{-1} x \cdot \frac{x^2}{1+x^2} \, dx \]

\[ x = \tan \theta \quad \Rightarrow \quad dx = \sec^2 \theta \, d\theta \]

\[ = \frac{\pi^2}{32} - \int_0^{\pi/4} \theta \cdot \tan^2 \theta \, d\theta \]

\[ = \frac{\pi^2}{32} - \int_0^{\pi/4} \theta \cdot \sec^2 \theta \, d\theta + \int_0^{\pi/4} \theta \, d\theta \]
$\frac{\pi^2}{32} - [\tan \theta]_0^{\pi/4} \int_0^{\pi/4} \tan \theta \ d\theta + \left[\frac{\theta^2}{2}\right]_0^{\pi/4}$

$= \frac{\pi^2}{32} - \frac{\pi}{4} + \left[\log \sec \theta\right]_0^{\pi/4} + \frac{\pi^2}{32}$

$= \frac{2\pi^2}{32} - \frac{\pi}{4} + \frac{1}{2} \log 2 \text{ or } \frac{\pi^2 - 4\pi}{16} - \frac{1}{2} \log 2$

26. Correct figure:

Correct Figure

Solving $x^2 + y^2 = 1$ and $x + \frac{y}{2} = 1$ to get $x = \frac{3}{5}$ and $x = 1$ as points of intersection

Required area $= \int_{3/5}^{1} \sqrt{1 - x^2} \ dx - \int_{3/5}^{1} (2 - 2x) \ dx$

$= \left[\frac{x}{2} \sqrt{1 - x^2} + \frac{1}{2} \sin^{-1} x\right]_{3/5}^{1} - \left[2x - x^2\right]_{3/5}^{1}$

$= \frac{\pi}{4} - \left(\frac{6}{25} + \frac{1}{2} \sin^{-1} \frac{3}{5}\right) - \left[1 - \frac{21}{25}\right]$ (1)

$= \left(\frac{\pi}{4} - \frac{2}{5} - \frac{1}{2} \sin^{-1} \frac{3}{5}\right) \text{ sq. u.}$
27. let \( E_1 \): randomly selected seed is \( A_1 \) type \( P(E_1) = \frac{4}{10} \)

\( E_2 \): randomly selected seed is \( A_2 \) type \( P(E_2) = \frac{4}{10} \)

\( E_3 \): randomly selected seed is \( A_3 \) type \( P(E_3) = \frac{2}{10} \)

(i) let \( A \): selected seed germinates

\[ \therefore P(A/E_1) = \frac{45}{100}, \quad P(A/E_2) = \frac{60}{100}, \quad P(A/E_3) = \frac{35}{100} \]

\[ \therefore P(A) = P(E_1) P(A/E_1) + P(E_2) P(A/E_2) + P(E_3) P(A/E_3) \]

\[ = \frac{4}{10} \times \frac{45}{100} + \frac{4}{10} \times \frac{60}{100} + \frac{2}{10} \times \frac{35}{100} \]

\[ = \frac{49}{100} \text{ or } 0.49 \]

(ii) let \( A \): selected seed does not germinate

\[ \therefore P(A/E_1) = \frac{55}{100}, \quad P(A/E_2) = \frac{40}{100}, \quad P(A/E_3) = \frac{65}{100} \]

\[ \therefore P(E_2/A) = \frac{P(E_2) P(A/E_2)}{P(E_1) P(A/E_1) + P(E_2) P(A/E_2) + P(E_3) P(A/E_3)} \]

\[ = \frac{\frac{4}{10} \times \frac{55}{100} + \frac{4}{10} \times \frac{40}{100} + \frac{2}{10} \times \frac{65}{100}}{1} \]

\[ = \frac{16}{51} \]

OR

Let \( E_1 \): transferred ball is red.

\( E_2 \): transferred ball is black.

\( A \): Getting both red from 2\(^{nd}\) bag (after transfer)

\[ P(E_1) = \frac{3}{7}, \quad P(E_2) = \frac{4}{7} \]
P(A/E1) = \frac{5 \binom{2}{10}}{\binom{10}{2}} = \frac{10}{45} \text{ or } \frac{2}{9} \hspace{1cm} 1

P(A/E2) = \frac{4 \binom{2}{10}}{\binom{10}{2}} = \frac{6}{45} \text{ or } \frac{2}{15} \hspace{1cm} 1

P(E_1/A) = \frac{P(E_1).P(A|E_1)}{P(E_1).P(A|E_1) + P(E_2).P(A|E_2)} \hspace{1cm} \frac{1}{2}

= \frac{3 \cdot \frac{2}{9}}{\frac{7}{9} \cdot \frac{2}{9} + \frac{2}{15}} = \frac{5}{9} \hspace{1cm} 1+1

28. The three equations are \[\begin{align*}
3x + 2y + z &= 1.28 \\
4x + y + 3z &= 1.54 \\
x + y + z &= 0.57
\end{align*}\]

\[\begin{bmatrix}
3 & 2 & 1 \\
4 & 1 & 3 \\
1 & 1 & 1
\end{bmatrix}
\begin{bmatrix}
x \\
y \\
z
\end{bmatrix}
= 
\begin{bmatrix}
1.28 \\
1.54 \\
0.57
\end{bmatrix} \hspace{1cm} \text{i.e. } AX = B \hspace{1cm} \frac{1}{2}

|A| = -5 \text{ and } X = A^{-1}B \hspace{1cm} 1

A^{-1} = \frac{1}{5}
\begin{bmatrix}
2 & 1 & -5 \\
1 & -2 & 5 \\
-3 & 1 & 5
\end{bmatrix} \hspace{1cm} 1

\Rightarrow
\begin{bmatrix}
x \\
y \\
z
\end{bmatrix}
= \frac{1}{5}
\begin{bmatrix}
2 & 1 & -5 \\
1 & -2 & 5 \\
-3 & 1 & 5
\end{bmatrix}
\begin{bmatrix}
1.28 \\
1.54 \\
0.57
\end{bmatrix}
= 
\begin{bmatrix}
0.25 \\
0.21 \\
0.11
\end{bmatrix} \hspace{1cm} \frac{1}{2}

x = 25000, \ y = 21000, \ z = 11000 \hspace{1cm} 1\frac{1}{2}

29. Let length be x m and breadth be y m.

\therefore \text{ length of fence } L = x + 2y

Let given area = a \Rightarrow xy = a \text{ or } y = \frac{a}{x}

\Rightarrow \ L = x + \frac{2a}{x} \hspace{1cm} 1
\[
\frac{dL}{dx} = 1 - \frac{2a}{x^2} \\
\frac{dL}{dx} = 0 \implies x^2 = 2a \quad \therefore x = \sqrt{2a} \\
\frac{d^2L}{dx^2} = \frac{2a}{x^3} > 0
\]

\Rightarrow \text{ for minimum length } L = \sqrt{2a} + \frac{2a}{\sqrt{2a}} = 2\sqrt{2a} \\
\begin{align*}
x &= \sqrt{2a} \text{ and breadth } y = \frac{a}{\sqrt{2a}} = \frac{\sqrt{2a}}{2} = \frac{1}{2}x
\end{align*}

\Rightarrow x = 2y
## SYLLABUS
### PHYSICS (042)
#### CLASS-XII (2013-14)

<table>
<thead>
<tr>
<th>One Paper</th>
<th>Time: 3 Hours</th>
<th>70 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I: Electrostatics</td>
<td></td>
<td>08</td>
</tr>
<tr>
<td>Unit II: Current Electricity</td>
<td></td>
<td>07</td>
</tr>
<tr>
<td>Unit III: Magnetic effect of current &amp; Magnetism</td>
<td></td>
<td>08</td>
</tr>
<tr>
<td>Unit IV: Electromagnetic Induction and Alternating current</td>
<td></td>
<td>08</td>
</tr>
<tr>
<td>Unit V: Electromagnetic Waves</td>
<td></td>
<td>03</td>
</tr>
<tr>
<td>Unit VI: Optics</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Unit VII: Dual Nature of Matter</td>
<td></td>
<td>04</td>
</tr>
<tr>
<td>Unit VIII: Atoms and Nuclei</td>
<td></td>
<td>06</td>
</tr>
<tr>
<td>Unit IX: Electronic Devices</td>
<td></td>
<td>07</td>
</tr>
<tr>
<td>Unit X: Communication Systems</td>
<td></td>
<td>05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>

The question paper will include value based question(s) to the extent of 3-5 marks.

### Unit I: Electrostatics

(Periods 25)

Electric Charges; Conservation of charge, Coulomb’s law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field.
Electric flux, statement of Gauss’s theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor. Van de Graaff generator.

**Unit II: Current Electricity**

(Periods 22)

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm’s law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.

Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.

Kirchhoff’s laws and simple applications. Wheatstone bridge, metre bridge.

Potentiometer - principle and its applications to measure potential difference and for comparing emf of two cells; measurement of internal resistance of a cell.

**Unit III: Magnetic Effects of Current and Magnetism**

(Periods 25)

Concept of magnetic field, Oersted’s experiment.

Biot - Savart law and its application to current carrying circular loop.

Ampere’s law and its applications to infinitely long straight wire. Straight and toroidal solenoids, Force on a moving charge in uniform magnetic and electric fields. Cyclotron.
Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors-definition of ampere. Torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth’s magnetic field and magnetic elements. Para-, dia- and ferro -magnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets.

Unit IV: Electromagnetic Induction and Alternating Currents  (Periods 20)

Electromagnetic induction; Faraday’s laws, induced emf and current; Lenz’s Law, Eddy currents. Self and mutual induction.

Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current.

AC generator and transformer.

Unit V: Electromagnetic waves  (Periods 4)

Need for displacement current, Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics  (Periods 30)

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker’s formula. Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror. Refraction and dispersion of light through a prism.
Scattering of light - blue colour of sky and reddish appearance of the sun at sunrise and sunset.

**Optical instruments**: Human eye, image formation and accommodation correction of eye defects (myopia, hypermetropia) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.


**Unit VII: Dual Nature of Matter and Radiation** (Periods 8)

Dual nature of radiation. Photoelectric effect, Hertz and Lenard’s observations; Einstein’s photoelectric equation-particle nature of light.

Matter waves-wave nature of particles, de Broglie relation. Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

**Unit VIII: Atoms & Nuclei** (Periods 18)

Alpha-particle scattering experiment; Rutherford’s model of atom; Bohr model, energy levels, hydrogen spectrum.

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity-alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear fusion.

**Unit IX: Electronic Devices** (Periods 18)

Energy bands in solids (Qualitative ideas only) conductors, insulator and
semiconductors; semiconductor diode – I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor, transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

**Unit X: Communication Systems**

Elements of a communication system (block diagram only); bandwidth of signals (speech, TV and digital data); bandwidth of transmission medium. Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation. Need for modulation. Production and detection of an amplitude-modulated wave.

**Practicals**

Every student will perform at least 15 experiments (7 from section A and 8 from Section B) The activities mentioned here should only be for the purpose of demonstration. One Project of three marks is to be carried out by the students.

**B. Evaluation Scheme for Practical Examination:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two experiments one from each section</td>
<td>8+8 Marks</td>
</tr>
<tr>
<td>Practical record (experiments &amp; activities)</td>
<td>6 Marks</td>
</tr>
<tr>
<td>Project</td>
<td>3 Marks</td>
</tr>
<tr>
<td>Viva on experiments &amp; project</td>
<td>5 Marks</td>
</tr>
</tbody>
</table>
Total 30 Marks

SECTION A

Experiments

(Any 7 experiments out of the following to be performed by the students)

1. To find resistance of a given wire using metre bridge and hence determine the specific resistance of its material
2. To determine resistance per cm of a given wire by plotting a graph of potential difference versus current.
3. To verify the laws of combination (series/parallel) of resistances using a metre bridge.
4. To compare the emf of two given primary cells using potentiometer.
5. To determine the internal resistance of given primary cell using potentiometer.
6. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
7. To convert the given galvanometer (of known resistance and figure of merit) into an ammeter and voltmeter of desired range and to verify the same.
8. To find the frequency of the a.c. mains with a sonometer.

Activities

1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.
6. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.
SECTION B

Experiments
(Any 8 experiments out of the following to be performed by the students)

1. To find the value of v for different values of u in case of a concave mirror and to find the focal length.

2. To find the focal length of a convex mirror, using a convex lens.

3. To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and 1/v.

4. To find the focal length of a concave lens, using a convex lens.

5. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.

6. To determine refractive index of a glass slab using a travelling microscope.

7. To find refractive index of a liquid by using (i) concave mirror, (ii) convex lens and plane mirror.

8. To draw the I-V characteristic curve of a p-n junction in forward bias and reverse bias.

9. To draw the characteristic curve of a zener diode and to determine its reverse breakdown voltage.

10. To study the characteristic of a common - emitter npn or pnp transistor and to find out the values of current and voltage gains.

Activities (For the purpose of demonstration only)

1. To identify a diode, an LED, a transistor, and IC, a resistor and a capacitor from mixed collection of such items.

2. Use of multimeter to (i) identify base of transistor (ii) distinguish between npn and pnp type transistors (iii) see the unidirectional flow of current in case of a diode and an LED (iv) check whether a given electronic component (e.g. diode, transistor or
IC) is in working order.

3. To study effect of intensity of light (by varying distance of the source) on an L.D.R.

4. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.

5. To observe polarization of light using two Polaroids.

6. To observe diffraction of light due to a thin slit.

7. To study the nature and size of the image formed by (i) convex lens (ii) concave mirror, on a screen by using a candle and a screen (for different distances of the candle from the lens/ mirror).

8. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.
SUGGESTED INVESTIGATORY PROJECTS

CLASS XII

1. To study various factors on which the internal resistance/emf of a cell depends.

2. To study the variations, in current flowing, in a circuit containing a LDR, because of a variation.
   (a) in the power of the incandescent lamp, used to 'illuminate' the LDR. (Keeping all the lamps at a fixed distance).
   (b) in the distance of a incandescent lamp, (of fixed power), used to 'illuminate' the LDR.

3. To find the refractive indices of (a) water (b) oil (transparent) using a plane mirror, a equiconvex lens, (made from a glass of known refractive index) and an adjustable object needle.

4. To design an appropriate logic gate combinatin for a given truth table.

5. To investigate the relation between the ratio of
   (i) output and input voltage and
   (ii) number of turns in the secondary coil and primary coil of a self designed transformer.

6. To investigate the dependence, of the angle of deviation, on the angle of incidence, using a hollow prism filled, one by one, with different transparent fluids.

7. To estimate the charge induced on each one of the two identical styro foam (or pith) balls suspended in a vertical plane by making use of Coulomb's law.

8. To set up a common base transistor circuit and to study its input and output characteristic and to calculate its current gain.

9. To study the factor, on which the self inductance, of a coil, depends, by observing the effect of this coil, when put in series with a resistor/(bulb) in a circuit fed up by an a.c. source of adjustable frequency.

10. To construct a switch using a transistor and to draw the graph between the input and output voltage and mark the cut-off, saturation and active regions.

11. To study the earth's magnetic field using a tangent galvanometer.
SAMPLE QUESTION PAPER

PHYSICS (042)

CLASS XII (2013-14)

Design of Question paper

Time: 3 hrs.  
Maximum Marks: 70

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows:

A. Weightage to different units

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electrostatics</td>
<td>08</td>
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<tr>
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<td>Electromagnetic waves</td>
<td>03</td>
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<tr>
<td>6.</td>
<td>Optics</td>
<td>14</td>
</tr>
<tr>
<td>7.</td>
<td>Dual Nature of Radiation and Matter</td>
<td>04</td>
</tr>
<tr>
<td>8.</td>
<td>Atoms and Nuclei</td>
<td>06</td>
</tr>
<tr>
<td>9.</td>
<td>Electronic Devices</td>
<td>07</td>
</tr>
<tr>
<td>10.</td>
<td>Communication Systems</td>
<td>05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>
### B. Weightage to form of questions

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of question</th>
<th>Marks per Question</th>
<th>Total number of Questions</th>
<th>Total marks</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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<td>8</td>
<td>8</td>
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<tr>
<td>2</td>
<td>SA I</td>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>SA II/Value Based Question</td>
<td>3</td>
<td>9</td>
<td>27</td>
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<tr>
<td>4</td>
<td>LA</td>
<td>5</td>
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</table>

### C. Typology of Questions

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<tr>
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<th>Weightage in marks</th>
<th>Weightage in percentage</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Knowledge Based</td>
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<tr>
<td>2</td>
<td>Conceptual Understanding</td>
<td>21</td>
<td>30%</td>
</tr>
<tr>
<td>3</td>
<td>Inferential Type</td>
<td>14</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>Reasoning Based</td>
<td>11</td>
<td>15%</td>
</tr>
<tr>
<td>5</td>
<td>Skill Based</td>
<td>10</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>70</td>
<td>100%</td>
</tr>
</tbody>
</table>

### D. Weightage to Numericals

The question paper will include numerical questions of 12-15 marks.
E. Scheme of options

There will be no overall choice. However, internal choice in any one question of two marks, any one question of three marks and all the three questions of five marks weightage has been provided.

F. Difficulty level of questions

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Estimated difficulty level</th>
<th>Percentage of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>Difficult</td>
<td>15</td>
</tr>
</tbody>
</table>

The question paper will include value based question(s) to the extent of 3–5 marks.
## PHYSICS
### CLASS - XII
### SAMPLE PAPER
### BLUE PRINT

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Unit</th>
<th>VSA (1 mark)</th>
<th>SA I (2 marks)</th>
<th>SA II/VBQ* (3 marks)</th>
<th>LA (5 marks)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electrostatics</td>
<td>1 (1)</td>
<td>4 (2)</td>
<td>3 (1)</td>
<td>–</td>
<td>8 (4)</td>
</tr>
<tr>
<td>2.</td>
<td>Current Electricity</td>
<td>2 (2)</td>
<td>2 (1)</td>
<td>3 (1)</td>
<td>–</td>
<td>7 (4)</td>
</tr>
<tr>
<td>3.</td>
<td>Magnetic effect of current &amp; Magnetism</td>
<td>1 (1)</td>
<td>4 (2)</td>
<td>3 (1)</td>
<td>–</td>
<td>8 (4)</td>
</tr>
<tr>
<td>4.</td>
<td>Electromagnetic Induction and Alternating Current</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td>–</td>
<td>5 (1)</td>
<td>8 (3)</td>
</tr>
<tr>
<td>5.</td>
<td>Electromagnetic Waves</td>
<td>–</td>
<td>–</td>
<td>3 (1)</td>
<td>–</td>
<td>3 (1)</td>
</tr>
<tr>
<td>6.</td>
<td>Optics</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td>6 (2)</td>
<td>5 (1)</td>
<td>14 (5)</td>
</tr>
<tr>
<td>7.</td>
<td>Dual nature of Radiation and matter</td>
<td>–</td>
<td>4 (2)</td>
<td>–</td>
<td>–</td>
<td>4 (2)</td>
</tr>
<tr>
<td>8.</td>
<td>Atoms and Nuclei</td>
<td>–</td>
<td>–</td>
<td>3 (1)</td>
<td>3 (1)*</td>
<td>6 (2)</td>
</tr>
<tr>
<td>9.</td>
<td>Electronic Devices</td>
<td>–</td>
<td>2 (1)</td>
<td>–</td>
<td>5 (1)</td>
<td>7 (2)</td>
</tr>
<tr>
<td>10.</td>
<td>Communication Systems</td>
<td>2 (2)</td>
<td>–</td>
<td>3 (1)</td>
<td>–</td>
<td>5 (3)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>8 (8)</strong></td>
<td><strong>20 (10)</strong></td>
<td><strong>27 (9)</strong></td>
<td><strong>15 (3)</strong></td>
<td><strong>70 (30)</strong></td>
</tr>
</tbody>
</table>

The question paper will include value based question(s) to the extent of 3–5 marks.
PHYSICS CLASS-XII
SAMPLE PAPER-1

Q1. A magnet is being moved towards a coil with a uniform speed $\vartheta$ as shown in the figure. State the direction of the induced current in the resistor R.

[Diagram of a magnet moving towards a coil]

Q2. A square coil, OPQR, of side a, carrying a current I, is placed in the Y-Z plane as shown here. Find the magnetic moment associated with this coil.

[Diagram of a square coil in Y-Z plane]

Q3. Give one example each of a ‘system’ that uses the

(i) Sky wave
(ii) Space wave

mode of propagation

Q4. A concave mirror, of aperture 4cm, has a point object placed on its principal axis at a distance of 10cm from the mirror. The image, formed by the mirror, is not likely to be a sharp image. State the likely reason for the same.

Q5. Two dipoles, made from charges $\pm q$ and $\pm Q$, respectively, have equal dipole moments. Give the (i) ratio between the ‘separations’ of the these two pairs of charges (ii) angle between the dipole axis of these two dipoles.
Q6. The graph, shown here, represents the V-I characteristics of a device. Identify the region, if any, over which this device has a negative resistance.

![Graph Image]

Q7. Define the term ‘Transducer’ for a communication system.

Q8. State the steady value of the reading of the ammeter in the circuit shown below.

![Circuit Image]

Q9. The following table gives data about the single slit diffraction experiment:

<table>
<thead>
<tr>
<th>Wave length of Light</th>
<th>Half Angular width of the principal maxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda$</td>
<td>$\theta$</td>
</tr>
<tr>
<td>$p\lambda$</td>
<td>$q\theta$</td>
</tr>
</tbody>
</table>

Find the ratio of the widths of the slits used in the two cases. Would the ratio of the half angular widths of the first secondary maxima, in the two cases, be also equal to $q$?

Q10. N spherical droplets, each of radius $r$, have been charged to have a potential $V$ each. If all these droplets were to coalesce to form a single large drop, what would be the potential of this large drop?

(It is given that the capacitance of a sphere of radius $r$ equals $4\pi \epsilon_0 r$.)
OR

Two point charges, $q_1$ and $q_2$, are located at points $(a, 0, 0)$ and $(0, b, 0)$ respectively. Find the electric field, due to both these charges, at the point, $(0, 0, c)$.  

Q11. When a given photosensitive material is irradiated with light of frequency $\nu$, the maximum speed of the emitted photoelectrons equals $v_{\text{max}}$. The square of $v_{\text{max}}$, i.e., $v_{\text{max}}^2$, is observed to vary with $\nu$, as per the graph shown here.

![Graph showing $v_{\text{max}}^2$ vs $\nu$](image)

Obtain expressions for

(i) Planck's constant, and

(ii) The work function of the given photosensitive material, in terms of the parameters, $\ell$, $n$ and the mass, $m$, of the electron.

Q12. For the circuit shown here, would the balancing length increase, decrease or remain the same, if

(i) $R_1$ is decreased
(ii) $R_2$ is increased

without any other change, (in each case) in the rest of the circuit. Justify your answers in each case.
Q13. Find the P.E. associated with a charge ‘q’ if it were present at the point P with respect to the ‘set-up’ of two charged spheres, arranged as shown. Here O is the mid-point of the line O₁O₂.

Q14. An athlete peddles a stationary tricycle whose pedals are attached to a coil having 100 turns each of area 0.1m². The coil, lying in the X-Y plane, is rotated, in this plane, at the rate of 50 rpm, about the Y-axis, in a region where a uniform magnetic field, \( \vec{B} = (0.01) \hat{k} \) tesla, is present. Find the

(i) maximum emf
(ii) average e.m.f

generated in the coil over one complete revolution.

Q15. A monochromatic source, emitting light of wave length, 600 nm, has a power output of 66W. Calculate the number of photons emitted by this source in 2 minutes.

Q16. For the circuit shown here, find the current flowing through the 1Ω resistor. Assume that the two diodes, D₁ and D₂, are ideal diodes.

Q17. The following table shows the range of values of susceptibility and relative magnetic permeability of two different type of magnetic substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>Susceptibility</th>
<th>Magnetic Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>-1 to 0</td>
<td>0 to 1</td>
</tr>
<tr>
<td>Y</td>
<td>&gt;&gt; 1</td>
<td>&gt;&gt; 1</td>
</tr>
</tbody>
</table>
(a) Identify the type of magnetic materials X and Y.

(b) How does the susceptibility and permeability of X and Y vary with rise in temperature?

Q18. Two wires are aligned parallel to each other. One is carrying an electric current and the other is not. Will there be any kind of electromagnetic force between the two? Give reason for your answer.

Q19. The galvanometer, in each of the two given circuits, does not show any deflection. Find the ratio of the resistors R₁ and R₂, used in these two circuits.

Q20. The electron, in a hydrogen atom, initially in a state of quantum number n₁ makes a transition to a state whose excitation energy, with respect to the ground state, is 10.2 eV. If the wavelength, associated with the photon emitted in this transition, is 487.5 mm, find the

(i) energy in ev, and (ii) value of the quantum number, n₁ of the electron in its initial state.

OR

The spectrum of a star in the visible and the ultraviolet region was observed and the wavelength of some of the lines that could be identified were found to be

824 Å, 970 Å, 1120 Å, 2504 Å, 5173 Å, 6100 Å.

Which of these lines cannot belong to hydrogen atom spectrum? Support your answer with suitable calculations.

Take Rydberg constant \( R = 1.03 \times 10^7 \text{ m}^{-1} \) and \( \frac{1}{r} = 970 \text{ Å}. \)
Q21. Three identical polaroid sheets \( P_1, P_2, \) and \( P_3 \) are oriented so that the (pass) axis of \( P_2 \) and \( P_3 \) are inclined at angles of \( 60^0 \) and \( 90^0 \), respectively, with respect to the (pass) axis of \( P_1 \). A monochromatic source, \( S \), of intensity \( I_0 \), is kept in front of the polaroid sheet \( P_1 \). Find the intensity of this light, as observed by observers \( O_1, O_2, \) and \( O_3 \), positioned as shown below.

Q22. A fine pencil of \( \beta \)-particles, moving with a speed \( \vartheta \), enters a region (region I), where a uniform electric and a uniform magnetic field are both present. These \( \beta \)-particles then move into region II where only the magnetic field, (out of the two fields present in region I), exists. The path of the \( \beta \)-particles, in the two regions, is as shown in the figure.

(i) State the direction of the magnetic field.

(ii) State the relation between ‘E’ and ‘B’ in region I.

(iii) Drive the expression for the radius of the circular path of the \( \beta \)-particle in region II.

If the magnitude of magnetic field, in region II, is changed to \( n \) times its earlier value, (without changing the magnetic field in region I) find the factor by which the radius of this circular path would change. 3

Q23. Draw an appropriate ray diagram to show the passage of a ‘white ray’, incident on one of the two refracting faces of a prism. State the relation for the angle of deviation, for a prism of small refracting angle.

It is known that the refractive index, \( \mu \), of the material of a prism, depends on the wavelength , \( \lambda \), of the incident radiation as per the relation

\[
\mu = A + \frac{B}{\lambda^2}
\]
where A and B are constants. Plot a graph showing the dependence of $\mu$ on $\lambda$ and identify the pair of variables, that can be used here, to get a straight line graph.

Q24. Excessively large amount of energy is released in an uncontrolled way in a nuclear bomb explosion. Some scientists have expressed fear that a future nuclear war on Earth would be followed by a severe ‘nuclear winter’ with a devastating effect on life on Earth.

**Answer the following questions based on above possible scenario:**

a) Name the basic principle responsible for release of large amount of energy in a nuclear bomb explosion. How will the nuclear bomb explosion result in ‘nuclear winter’?

b) Which two human values need to be promoted in individuals so that such a situation of nuclear winter does not arise?

c) Suggest any one method to promote these values in school students.

Q25. The modulation index of an amplitude modulated wave is 0.5. What does it mean?

Calculate the modulation index for an AM wave for which the maximum amplitude is ‘a’ while the minimum amplitude is ‘b’.

Q26. The capacitors $C_1$, and $C_2$, having plates of area A each, are connected in series, as shown. Compare the capacitance of this combination with the capacitor $C_3$, again having plates of area A each, but ‘made up’ as shown in the figure.

Q27. (a) Write the formula for the velocity of light in a material medium of relative permittivity $\varepsilon_r$ and relative magnetic permeability $\mu_r$. 
(b) The following table gives the wavelength range of some constituents of the electromagnetic spectrum.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Wavelength Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1mm to 700nm</td>
</tr>
<tr>
<td>2.</td>
<td>0.1m to 1mm</td>
</tr>
<tr>
<td>3.</td>
<td>400 nm to 1nm</td>
</tr>
<tr>
<td>4.</td>
<td>$&lt; 10^{-3}$ nm</td>
</tr>
</tbody>
</table>

Select the wavelength range, and name the (associated) electromagnetic waves, that are used in

(i) Radar systems for Aircraft navigation

(ii) Earth satellites to observe growth of crops.

Q28. A conducting rod XY slides freely on two parallel rails, A and B, with a uniform velocity ‘V’. A galvanometer ‘G’ is connected, as shown in the figure, and the closed circuit has a total resistance ‘R’. A uniform magnetic field, perpendicular to the plane defined by the rails A and B and the rod XY (which are mutually perpendicular), is present over the region, as shown.

(a) With key k open:

(i) Find the nature of charges developed at the ends of the rod XY.

(ii) Why do the electrons, in the rod XY, (finally) experience no net force even through the magnetic force is acting on them due to the motion of the rod?

(b) How much power needs to be delivered, (by an external agency), to keep the rod moving at its uniform speed when key k is (i) closed (ii) open?

(c) With key k closed, how much power gets dissipated as heat in the circuit? State the source of this power.
‘Box’ A, in the set up shown below, represents an electric device often used/needed to supply, electric power from the (ac) mains, to a load.

It is known that $V_o < V_i$.

(a) Identify the device A and draw its symbol.

(b) Draw a schematic diagram of this electric device. Explain its principle and working. Obtain an expression for the ratio between its output and input voltages.

(c) Find the relation between the input and output currents of this device assuming it to be ideal.

Q29. Define the terms ‘depletion layer’ and ‘barrier potential’ for a P-N junction diode. How does an increase in the doping concentration affect the width of the depletion region?

Draw the circuit of a full wave rectifier. Explain its working.

OR

Why is the base region of a transistor kept thin and lightly doped?

Draw the circuit diagram of the ‘set-up’ used to study the characteristics of a npn transistor in its common emitter configuration. Sketch the typical (i) Input characteristics and (ii) Output characteristics for this transistor configuration.

How can the output characteristics be used to calculate the ‘current gain’ of the transistor?

Q30. (i) A thin lens, having two surfaces of radii of curvature $r_1$ and $r_2$, made from a material of refractive index $\mu_2$, is kept in a medium of refractive index $\mu_1$. Derive the Lens Maker’s formula for this ‘set-up’
(ii) A convex lens is placed over a plane mirror. A pin is now positioned so that there is no parallax between the pin and its image formed by this lens-mirror combination. How can this observation be used to find the focal length of the convex lens? Give appropriate reasons in support of your answer.

OR

The figure, drawn here, shows a modified Young’s double slit experimental set up. If $SS_2 - SS_1 = \lambda/4$,

(i) state the condition for constructive and destructive interference

(ii) obtain an expression for the fringe width.

(iii) locate the position of the central fringe.
## MARKING SCHEME

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Value point/ expected points</th>
<th>Marks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>From X to Y</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>The magnetic moment, associated with the coil, is  ( \vec{\mu}_m = Ia^2 \hat{t} )</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>(i) Short wave broadcast services</td>
<td>½</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(ii) Television broadcast (or microwave links or Satellite communication)</td>
<td>½</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>The incident rays are not likely to be paraxial.</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
| 5.    | As \( qa = qa' \), we have  
\[
\frac{a'}{a} = \frac{q}{q'} \\
\text{and} \, \theta = 0^\circ
\]  | ½, ½ | 1     |
| 6.    | Region BC                     | 1     | 1     |
| 7.    | A ‘transducer’ is any device that converts one form of energy into another | 1     | 1     |
| 8.    | Zero                          | 1     | 1     |
| 9.    | Let \( d \) and \( d' \) be the width of the slits in the two cases.  
\[
\therefore \, \theta = \frac{\lambda}{d} \text{ and } q\theta = \frac{p\lambda}{d'} \\
\therefore \, \frac{d}{d'} = \frac{q}{p}
\]  | ½+½, ½ | 2     |
|       | Yes, this ratio would also equal \( q \) | ½     |       |
| 10.   | Total (initial) charge on all the droplets |     |       |
\[ = N \times (4\pi \varepsilon_0 k r V) \]

Also \[ N \times \frac{4}{3} \pi r^3 = \frac{4}{3} \pi R^3 \]

\[ \therefore R = N^{1/3} r \]

If \( V' \) is the potential of the large drop, we have

\[ 4\pi \varepsilon_0 R \times V' = N \times 4\pi \varepsilon_0 kr \times V \]

\[ \therefore V' = \frac{N r}{R} V = N^{2/3} V \]

OR

We have \( \vec{E}_{net} = \vec{E}_1 + \vec{E}_2 \)

\[ = \frac{1}{4\pi \varepsilon_0} \frac{q_1}{r_1^2} \hat{r}_1 + \frac{1}{4\pi \varepsilon_0} \frac{q_2}{r_2^2} \hat{r}_2 \]

where \( \hat{r}_1 = -a \hat{i} + c \hat{k} \)

and \( \hat{r}_2 = -b \hat{j} + c \hat{k} \)

\[ \vec{E}_{net} = \frac{1}{4\pi \varepsilon_0} \left[ \frac{q_1 (-a \hat{i} + c \hat{k})}{(a^2 + c^2)^{3/2}} + \frac{q_2 (-b \hat{j} + c \hat{k})}{(b^2 + c^2)^{3/2}} \right] \]

11. According to Einstein’s Equation:

\[ \theta_{max}^2 \frac{m}{2} = \frac{h^2}{\pi} - \phi_o \]

\[ \therefore \theta_{max}^2 = \left( \frac{2h}{m} \right)^2 - \frac{2\phi_o}{m} \]

This is the equation of a straight line having a slope \( \frac{2h}{m} \) and an intercept (on the \( \theta_{max}^2 \) axis) of \( -\frac{2\phi_o}{m} \). Comparing these, with the given graph, we get

\[ \frac{2h}{m} = \frac{\ell}{n} \text{ or } h = \frac{\ell m}{2n} \text{ and } \ell = \frac{2\phi_o}{m} \text{ or } \phi_o = \frac{m\ell}{2} \]

12. (i) decreases

(The potential gradient would increase)
(ii) increases
(The terminal p.d across the cell would increase) \[ \frac{1}{2} + \frac{1}{2} \]

13. \[ r_1 = O_1P = \sqrt{r^2 + (2a + b)^2} \]
   \[ r_2 = O_2P = \sqrt{r^2 + (a + 2b)^2} \]
   \[ \therefore V = \frac{1}{4\pi \varepsilon_0} \left[ \frac{Q_1}{r_1} + \frac{Q_2}{r_2} \right] \]
   \[ \therefore \text{P.E of charge, } q, \text{ at } P = qV \]
   \[ = \frac{q}{4\pi \varepsilon_0} \left[ \frac{Q_1}{\left[r^2 + (2a + b)^2\right]^{1/2}} + \frac{Q_2}{\left[r^2 + (a + 2b)^2\right]^{1/2}} \right] \]

14. (i) The maximum emf \( \varepsilon \) generated in the coil is,
   \[ \varepsilon = NBAt \omega \]
   \[ = NBAt2\pi f \]
   \[ = \left[100 \times 0.01 \times 0.1 \times 2\pi \left(\frac{51}{6}\right)\right] V \]
   \[ = \frac{\pi}{6} V \approx 0.52 \text{ V} \]
   \[ \text{(ii) The average emf generated in the coil over one complete revolution } = 0 \]

15. Energy of one photon = \( E = \frac{hc}{\lambda} \)
   \[ E = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{6 \times 10^{-7}} \]
   \[ \approx 3.3 \times 10^{-19} \text{ J} \]
   \[ E_1 = \text{energy emitted by the source in one second } = 66 \text{ J} \]
   \[ \therefore \text{number of photons emitted by the source in } 1\text{s} = n = \frac{66}{3.3 \times 10^{-19}} = 2 \times 10^{20} \]
   \[ \therefore \text{Total number of photons emitted by } \]
source in 2 minutes

\[= N = n \times 2 \times 60\]
\[= 2 \times 10^{20} \times 120 = 2.4 \times 10^{22} \text{ photons}\]

| 16. | Diode D_1 is forward biased while Diode D_2 is reverse biased
|     | Hence the resistances, of (ideal) diodes, D_1 and D_2, can be taken as zero and infinity, respectively.
|     | The given circuit can, therefore, be redrawn as shown in the figure.
|     | ![Circuit Diagram](image)
|     | \[\frac{6}{2+1} \text{ A} = 2\text{A}\]
|     | \[\text{current flowing in the 1\Omega resistor, is 2A}\]

| 17. | (a) X-Diamagnetic,
|     | Y-Ferromagnetic
|     | (b) X- No change
|     | (c) Y- Decreases with temperature

| 18. | No
|     | - Since there is only one magnetic field, there is no interaction and hence no force between the two wires.

| 19. | For circuit 1, we have, (from the Wheatstone bridge balance condition),
\[ \frac{R_1}{9} = \frac{4}{6} \]

∴ \( R_1 = 6\Omega \)

In circuit 2, the interchange of the positions of the battery and the galvanometer, does not change the (wheatstone Bridge) balance condition.

\[ \frac{R_2}{8} = \frac{6}{12} \]

or \( R_2 = 4\Omega \)

\[ \therefore \frac{R_1}{R_2} = \frac{6}{4} = \frac{3}{2} \]

\[ \frac{E_{n1} - E_2}{\lambda} = \frac{hc}{\lambda} \]

But \( \frac{hc}{\lambda} = \frac{6.63 \times 10^{-24} \times 3 \times 10^8}{487.3 \times 10^{-9} \times 1.6 \times 10^{-19}} \) eV = 2.55 eV

∴ \( E_{n1} = (-3.4 + 2.55) \) eV

\[ \approx -0.85 \text{ eV} \]

But we also have \( E_{n1} = \frac{-13.6}{n_1^2} \) eV

∴ we get \( n_1 = 4 \)
OR

\[ \bar{\nu} = \frac{1}{\lambda} = R \left[ \frac{1}{n_2^2} - \frac{1}{n_1^2} \right] \]

\[ \lambda = \frac{1}{\frac{1}{n_2^2} - \frac{1}{n_1^2}} = \frac{970 \, \text{Å}}{\frac{1}{n_2^2} - \frac{1}{n_1^2}} \]

If we take \( n_2 = 1 \) (Lyman series of Hydrogen Spectrum)

\( \lambda \) can take values \( \frac{970 \, \text{Å}}{3/4} \), \( \frac{970 \, \text{Å}}{8/9} \), \( \frac{970 \, \text{Å}}{15/16} \), \( \frac{970 \, \text{Å}}{1} \)

Corresponding to \( n_1 = 2, 3, 4, \ldots \)

Thus, permitted values of \( \lambda \) are 1293 Å, 1091 Å, 1034 Å, \ldots, 970 Å.

Similarly if we take \( n_2 = 2 \) (Balmer Series of Hydrogen Spectrum), corresponding to \( n_1 \) = 3, 4, 5, \ldots

\( \lambda \) can have values

\( \frac{970 \, \text{Å}}{\frac{1}{16}}, \frac{970 \, \text{Å}}{\frac{1}{25}}, \frac{970 \, \text{Å}}{\frac{1}{100}}, \ldots, \frac{970 \, \text{Å}}{\frac{1}{4}} \)

i.e. 6984 Å, 5173 Å, 4619 Å, \ldots, 3880 Å.

Hence out of the given values

\( \lambda = 824 \, \text{Å}, 1120 \, \text{Å}, 2504 \, \text{Å}, 6100 \, \text{Å} \) cannot belong to the hydrogen atom spectrum.

21. Intensity observed by

(i) Observer \( O_1 = \frac{I_0}{2} \)

(ii) Observer \( O_2 = \frac{I_0}{2} \cos^2 60^\circ \)
(iii) \[ \text{Observer O}_3 = \left( \frac{l_0}{8} \right) \cos^2 (90^\circ - 60^\circ) \]
\[ = \frac{l_0}{8} \times \frac{3}{4} = \frac{3l_0}{32} \]

22. (i) The magnetic field is perpendicular to the plane of page and is directed inwards

(ii) In region I
\[ |\vec{P}_e| = |\vec{P}_m| \]
\[ qE = q \vartheta B \]
\[ \therefore E = \vartheta B \]

(iii) In region II
\[ \frac{mv^2}{r} = q\vartheta B \Rightarrow r = \frac{m\vartheta}{qB} \]
Substituting the value of \( \vartheta \), we get
\[ r = \frac{mE}{qB^2} \]
Let \( B' = nB \) denote the new magnetic field in region II. If \( r' \) is the radius of the circular path now, we have
\[ \Rightarrow r'^2 = \frac{m\vartheta}{qB'} = \frac{mE}{qnB^2} \]
Hence radius of the circular path, would decrease by a factor \( n \).

23. See (fig 9.25, Page 332 Part II NCERT)
For a small angled prism, of refracting angle \( \alpha \):
Angle of deviation \( \alpha = (\mu - 1) \alpha \) where \( \mu \) is
the refractive index of the material of the prism.

\[ \mu \]

To get a straight line graph, we need to use \( \mu \) and \( \frac{1}{\lambda^2} \) as the pair of variables.

24. a) - Uncontrolled nuclear chain reaction.

- The thick smoke produced due to nuclear explosion would perhaps cover substantial parts of the sky preventing solar light from reaching many parts of the Earth resulting in lowering of atmospheric temperature.

b) - International understanding and Brotherhood.

- Love for humanity/non violence

c) - Group discussion for value clarification

- Vigorous campaign for spreading awareness using mass media.

25. • It means that the ratio of peak value of the modulating signal to the peak
value of carrier wave is 0.5.

- If $A_m$ is the peak value of modulating signal and $A_c$ is the peak value of carrier wave.

We have $a = A_c + A_m$

and $b = A_c - A_m$

Thus, $A_c = \frac{a + b}{2}$ and $A_m = \frac{a - b}{2}$

Therefore modulation index $\mu = \frac{A_m}{A_c} = \frac{a - b}{a + b}$

<table>
<thead>
<tr>
<th>26.</th>
<th>We have $C_1 = \frac{A\varepsilon_0 K_1}{d}$ and $C_2 = \frac{A\varepsilon_0 K_2}{d}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\therefore C_{eq} = \frac{C_1 C_2}{C_1 + C_2} = \frac{A\varepsilon_0}{d} \left( \frac{K_1 K_2}{K_1 + K_2} \right)$</td>
</tr>
</tbody>
</table>

Now, capacitor $C_3$ can be considered as made up of two capacitors $C_1$ and $C_2$, each of plate area $A$ and separation $d$, connected in series.

We have: $C_{1}' = \frac{A\varepsilon_0 K_1}{d}$ and $C_{2}' = \frac{A\varepsilon_0 K_2}{d}$

$\Rightarrow C_3 = \frac{C_{1} C_{2}'}{C_{1} + C_{2}'} = \frac{A\varepsilon_0}{d} \left( \frac{K_1 K_2}{K_2 + K_1} \right)$

$\therefore \frac{C_3}{C_{eq}} = 1$

Hence net capacitance of the combination is equal to that of $C_3$. |
27. (a) We have \( \frac{1}{\sqrt{\mu \varepsilon}} = \frac{1}{\sqrt{\mu_0 \varepsilon_0 \varepsilon_r}} \)

(b) (i) Wavelength range: [0.1m to 1mm] (Microwaves)
(ii) Wavelength range: [1mm to 700 nm] (Infrared waves)

28. (a) X: negative, Y: positive

(ii) Magnetic force, \( F_m \), experienced by the moving electrons, gets balanced by the electric force due to the electric field, caused by the charges developed at the ends of the rod. Hence net force on the electrons, inside the rod, (finally) become zero.

(b) The power, that needs to be delivered by the external agency, when key \( k \) is closed, is

\[
P = F_m V = (I I B)V = \frac{BIV}{R} \cdot BV
\]

\[
= B^2 I^2 V^2 / R
\]

When \( k \) is open, there is an induced emf, but no induced current. Hence power that needs to be delivered is zero.

(c) Power, dissipated as heat

\[
= i^2 R = \frac{B^2 I^2 V^2}{R}
\]

The source of this power is the mechanical work done by the external agency.
<table>
<thead>
<tr>
<th>OR</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Step down transformer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Transformer Diagram" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Diagram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principle</td>
<td></td>
<td>½</td>
</tr>
<tr>
<td>Working</td>
<td></td>
<td>½</td>
</tr>
<tr>
<td>Obtaining the expression</td>
<td></td>
<td>½</td>
</tr>
<tr>
<td>(c) Input power = output power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ V_p i_p = V_s i_s ]</td>
<td></td>
<td>½</td>
</tr>
<tr>
<td>[ \frac{i_p}{i_s} = \frac{V_s}{V_p} = \frac{N_s}{N_p} ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29. The space charge region, on either side of the junction (taken together), is known as the depletion layer.

The p.d across the depletion layer is known as the barrier potential.

The width of the depletion region decreases with an increase in the doping concentration.

The circuit of a full-wave rectifier is shown below.
Working details

OR

The base region of a transistor is thin and lightly doped so that the base current ($I_B$) is very small compared to emitter current ($I_E$).
The current gain ($\beta$) of a transistor in common emitter configuration is

$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

$\Delta I_C$ and $\Delta I_B$ can be obtained, from the two curves, in the output characteristics.

### 30.

(i) Diagram

Derivation

(ii) The rays must fall normally on the plane mirror so that the image of the pin coincides with itself

Hence rays, like CA and DB, form a parallel beam incident on the lens.

$\therefore$ P is the position of the focus of the lens

$\therefore$ Distance OP equals the focal length of the lens

OR
Δ₀ = initial path difference between S₁ and S₂
   = SS₂ - SS₁ = λ/4

Δ = S₂P - S₁P = path difference between disturbance from S₁ and S₂, at point P
   = \frac{yd}{D}

Δₜ = Total path difference between the two disturbances at P
   = Δ₀ + Δ = \frac{λ}{4} + \frac{yd}{D}

∴ For constructive interference:

Δₜ = \left(\frac{λ}{4} + \frac{yd}{D}\right) = nλ; n = 0, 1, 2,….

∴ \frac{yd}{D} = (n-\frac{1}{4}) λ ...(i)

For destructive interference

Δₜ = \left(\frac{λ}{4} + \frac{yd}{D}\right) = (2n-1) \frac{λ}{2} ...(ii)

∴ \frac{yd}{D} = \left(2n - \frac{1}{2}\right) \frac{λ}{2}

∴ \frac{yd}{D} = \left(2n - \frac{3}{2}\right) \frac{λ}{2}

β = fringe width = y_{n+1} - y_n = \frac{λD}{d}

The position Y₀ of central fringe is obtained by putting n=0 in Eqn (i). Therefore,

∴ y₀ = -\frac{λD}{4d}

[Negative sign shows that the central fringe is obtained at a point below the (central) point O.]
SYLLABUS
CHEMISTRY (043)
CLASS- XII- (2013-14)

Total Periods : 180
70 marks

Time: 3 Hours

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Title</th>
<th>Marks</th>
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<tbody>
<tr>
<td>Unit I</td>
<td>Solid State</td>
<td>4</td>
</tr>
<tr>
<td>Unit II</td>
<td>Solutions</td>
<td>5</td>
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<tr>
<td>Unit III</td>
<td>Electrochemistry</td>
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<tr>
<td>Unit IV</td>
<td>Chemical Kinetics</td>
<td>5</td>
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<tr>
<td>Unit V</td>
<td>Surface Chemistry</td>
<td>4</td>
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<tr>
<td>Unit VI</td>
<td>General Principles and Processes of Isolation of Elements</td>
<td>3</td>
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<tr>
<td>Unit VII</td>
<td>p-block Elements</td>
<td>8</td>
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<td>Unit VIII</td>
<td>d-and f-Block Elements</td>
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<tr>
<td>Unit IX</td>
<td>Coordination Compounds</td>
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<td>Unit X</td>
<td>Haloalkanes and Haloarenes</td>
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</tr>
<tr>
<td>Unit XI</td>
<td>Alcohols, Phenols and Ethers</td>
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<tr>
<td>Unit XII</td>
<td>Aldehydes, Ketones and Carboxylic Acids</td>
<td>6</td>
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<tr>
<td>Unit XIII</td>
<td>Organic Compounds containing Nitrogen</td>
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<td>Unit XIV</td>
<td>Biomolecules</td>
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<td>Unit XV</td>
<td>Polymers</td>
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<td>Unit XVI</td>
<td>Chemistry in Everyday Life</td>
<td>3</td>
</tr>
<tr>
<td>Total:</td>
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</tr>
</tbody>
</table>

The question paper will include value based question(s) to the extent of 3-5 marks.

Unit I: Solid State  (Periods 12)
Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea). Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and n & p type semiconductors.

Unit II: Solutions  (Periods 12)
Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoult’s law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, van’t Hoff factor.
Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell -electrolytic cells and Galvanic cells, lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and emf of a cell, fuel cells, corrosion.

Unit IV: Chemical Kinetics

Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst; order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.

Unit V: Surface Chemistry

Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids, catalysis, homogenous and heterogenous activity and selectivity; enzyme catalysis colloidal state distinction between true solutions, colloids and suspension; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.

Unit VI: General Principles and Processes of Isolation of Elements

Principles and methods of extraction - concentration, oxidation, reduction - electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

Unit VII: p -Block Elements

**Group -15 Elements:** General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen preparation properties & uses; compounds of nitrogen, preparation and properties of ammonia and nitric acid, oxides of nitrogen (Structure only); Phosphorus - allotropic forms, compounds of phosphorus: preparation and properties of phosphine, halides $\text{PCl}_3$, $\text{PCl}_5$ and oxoacids (elementary idea only).

**Group 16 Elements:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxogen: Preparation, Properties and uses, classification of oxides, Ozone, Sulphure - allotropic forms; compounds of sulphure: Preparation properties and uses of sulphur-dioxide, sulphuric acid: industrial process of manufacture, properties and uses; oxoacids of sulphur (Structures only).

**Group 17 Elements:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens. Preparation properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).

**Group 18 Elements:** General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.
Unit VIII: d and f Block Elements (Periods 14)

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals - metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of K₂Cr₂O₇ and KMnO₄.

Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

Actinoids - Electronic configuration, oxidation states and comparison with lanthanoids.

Unit IX: Coordination Compounds (Periods 12)

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereo isomerism, importance of coordination compounds (in qualitative inclusion, extraction of metals and biological system).

Unit X: Haloalkanes and Haloarenes. (Periods 12)

Haloalkanes: Nomenclature, nature of C -X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation.

Haloarenes: Nature of C -X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only).

Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform freons, DDT.

Unit XI: Alcohols, Phenols and Ethers (Periods 12)

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols.

Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

Unit XII: Aldehydes, Ketones and Carboxylic Acids (Periods 12)

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes: uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties: uses.
Unit XIII: Organic compounds containing Nitrogen (Periods 10)

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

Cyanides and Isocyanides - will be mentioned at relevant places in context.

Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit XIV: Biomolecules (Periods 12)

Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen) importance.

Proteins - Elementary idea of α- amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure.

Vitamins - Classification and functions.

Nucleic Acids: DNA and RNA.

Unit XV: Polymers (Periods 8)

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization, some important polymers: natural and synthetic like polythene, nylon polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

Unit XVI: Chemistry in Everyday life (Periods 8)

Chemicals in medicines - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food - preservations, artificial sweetening agents, elementary idea of antioxidants. Cleansing agents - soaps and detergents, cleansing action.
### Practical Evaluation Scheme for Examination

<table>
<thead>
<tr>
<th>Evaluation Scheme for Examination</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumetric Analysis</td>
<td>10</td>
</tr>
<tr>
<td>Salt Analysis</td>
<td>8</td>
</tr>
<tr>
<td>Content Based Experiment</td>
<td>6</td>
</tr>
<tr>
<td>Class record, project work and viva</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

### PRACTICAL SYLLABUS

**Micro-chemical methods are available for several of the practical experiments. Wherever possible, such techniques should be used.**

#### A. Surface Chemistry

(Periods 5)

(a) Preparation of one lyophilic and one lyophobic sol
    - Lyophilic sol - starch, egg albumin and gum
    - Lyophobic sol - aluminium hydroxide, ferric hydroxide, arsenous sulphide.

(b) Dialysis of sol-prepared in (a) above.

(c) Study of the role of emulsifying agents in stabilizing the emulsion of different oils.

#### B. Chemical Kinetics

(Periods 4)

(a) Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

(b) Study of reaction rates of any one of the following:

(i) Reaction of iodide ion with hydrogen peroxide at room temperature using different concentration of iodide ions.

(ii) Reaction between potassium iodate, (KIO₃) and sodium sulphite: (Na₂SO₃) using starch solution as indicator (clock reaction).

#### C. Thermochemistry

(Periods 4)

Any one of the following experiments

(i) Enthalpy of dissolution of copper sulphate or potassium nitrate.

(ii) Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH).

(iii) Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone and chloroform.
D. Electrochemistry (Periods 2)
Variation of cell potential in Zn/Zn$^{2+}$\|$Cu^{2+}$/Cu with change in concentration of electrolytes (CuSO$_4$ or ZnSO$_4$) at room temperature.

E. Chromatography (Periods 2)
i) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of Rf values.
ii) Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in Rf values to be provided).

F. Preparation of Inorganic Compounds (Periods 4)
i) Preparation of double salt of ferrous ammonium sulphate or potash alum.
ii) Preparation of potassium ferric oxalate.

G. Preparation of Organic Compounds (Periods 2)
Preparation of any one of the following compounds
i) Acetanilide
ii) Di -benzal acetone
iii) p-Nitroacetanilide
iv) Aniline yellow or 2 - Naphthol aniline dye.

H. Tests for the functional groups present in organic compounds: (Periods 6)
Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (Primary) groups.

I. Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given food stuffs. (Periods 4)

J. Determination of concentration/ molarity of KMnO$_4$ solution by titrating it against a standard solution of: (Periods 8)
i) Oxalic acid,
ii) Ferrous ammonium sulphate
(Students will be required to prepare standard solutions by weighing themselves).

K. Qualitative analysis (Periods 14)
Determination of one cation and one anion in a given salt.

Cation - Pb$^{2+}$, Cu$^{2+}$, As$^{3+}$,Fe$^{3+}$,Mn$^{2+}$, Zn$^{2+}$, Co$^{2+}$, Ni$^{2+}$, Ca$^{2+}$, Sr$^{2+}$, Ba$^{2+}$, Mg$^{2+}$.NH$_4^+$
Anions - Co\(^{2-}\), S\(^{2-}\), SO\(^{2-}\), NO\(^{-}\), NO\(^{3-}\), Cl\(^{-}\), Br\(^{-}\), I\(^{-}\), PO\(^{3-}\), C\(_2\)O\(^{2-}\), CH\(_3\)COO\(^{-}\)

(Note: Insoluble salts excluded)

PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

A few suggested Projects

- Study of the presence of oxalate ions in guava fruit at different stages of ripening.
- Study of quantity of casein present in different samples of milk.
- Preparation of soybean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.
- Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc.).
- Study of digestion of starch by salivary amylase and effect of pH and temperature on it.
- Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, potato juice, carrot juice etc.
- Extraction of essential oils present in Saunf (aniseed), Ajwain (carum), Illaichi (cardamom).
- Study of common food adulterants in fat, oil, butter, sugar, turmeric powder, chilli powder and pepper.

Note: Any investigatory project, which involves about 10 periods of work, can be chosen with the approval of the teacher.

Recommended Textbooks.

1. Chemistry Part -I, Published by NCERT.
2. Chemistry Part -II, Published by NCERT.
SAMPLE QUESTION PAPER
CHEMISTRY (043)
CLASS XII (2013-14)

Design of Question paper

Time: 3 hrs.                                                 Maximum Marks:70

A. Weightage to different forms of questions

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of question</th>
<th>Marks per Question</th>
<th>Total number of Questions</th>
<th>Total marks</th>
</tr>
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<tbody>
<tr>
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<td>VSA</td>
<td>1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>SA I</td>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>SA II/Value Based Question</td>
<td>3</td>
<td>9</td>
<td>27</td>
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<tr>
<td>4</td>
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<td>Total</td>
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<td>30</td>
<td>70</td>
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B. Typology of Questions

<table>
<thead>
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<th>Typology</th>
<th>Weightage in marks</th>
<th>Weightage in percentage</th>
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<tbody>
<tr>
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<tr>
<td>3</td>
<td>Inferential Type</td>
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<tr>
<td>4</td>
<td>Reasoning Based</td>
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<td>100%</td>
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</table>
C. Scheme of options

There will be no overall choice. However, internal choice in any one question of two marks, any one question of three marks and all the three questions of five marks weightage has been provided.

D. Difficulty level of questions

<table>
<thead>
<tr>
<th>S. No.</th>
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<tr>
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<tr>
<td>1.</td>
<td>Solid State</td>
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<tr>
<td>2.</td>
<td>Solutions</td>
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<td>3.</td>
<td>Electrochemistry</td>
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<td>4.</td>
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<tr>
<td>12.</td>
<td>Aldehydes, Ketones &amp; Carboxylic Acids</td>
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Key: Total marks (no. of questions)

* Value Based Question

**NOTE:**
- Value Based Questions may be asked from any unit / chapter / topic.
- It will carry 3-5 marks.
Q.1 Bond enthalpy of fluorine is lower than that of chlorine, why?

Q.2 Give the IUPAC name of the following compound:

\[
\text{(CH}_3\text{)}_3\text{C-C-COOH}
\]

Q.3 On increasing temperature, activation energy of a reaction decreases, why?

Q.4 Which of the following is most effective electrolyte in the coagulative of AgI/Ag+sol?

K\text{2SO}_4, \text{MgCl}_2, \text{K}_4[\text{Fe(CN)}_6]

Q.5 Write the reaction when glucose is heated with excess of HI.

Q.6 Which Xe compound has distorted octahedral shape?

Q.7 What is the denticity of co-ordination compound used for the treatment of lead Poisoning?

Q.8 An alkoxide is a stronger base than hydroxide ion. Justify.

Q.9 (a) State the law which helps to determine the limiting molar conductivity of weak electrolyte.

(b) Calculate limiting molar conductivity of CaSO\text{4} (limiting molar conductivity of calcium and sulphate ions are 119.0 and 160.0 S cm\textsuperscript{-2} mol\textsuperscript{-1} respectively).

Q.10 Rate constant K for first order reaction has been found to be 2.54 x 10\textsuperscript{-3} sec\textsuperscript{-1}. Calculate its three-fourth life.

OR

A first order gas reaction \text{A}_2\text{(g)}\text{B}_2\text{(g)} \rightarrow 2\text{A}_\text{(g)} + 2\text{B}_\text{(g)} at the temperature 400\textdegree \text{C} has the rate Constant K =2.0x10\textsuperscript{-4} \text{ sec}\textsuperscript{-1}. What percentage of \text{A}_2\text{B}_2 is decomposed on heating for 900 seconds.
Q.11 Do the following conversions:

(i) Methyl bromide to acetone.
(ii) Benzyl chloride to 2-phenyl acetic acid.

Q.12 How will you distinguish between the following pairs of compounds:

(i) Chloroform and carbon tetrachloride.
(ii) Benzyl alcohol and chlorobenzene.

Q.13 For a chemical reaction variation in rate with conc. is shown below:

\[ \text{Rate} \quad \text{Conc.} \rightarrow \]

What is the order of the reaction?
What are the units of rate constant K for the reaction?

Q.14 Give the electronic configuration of d-orbitals of \( K_3[Fe(CN)_6] \) and \( K_3[FeF_6] \) and explain why these complexes give different colour with same solution.

(At. No. Of Fe=26u)

Q.15 Give reason for the following:

(i) O-Toludine is more basic than aniline.
(ii) Tertiary amines do not undergo acetylation reaction.

Q.16 Write the following name reaction:

(i) Gabriel phthalimide reaction. (ii) Hoffman bromamide reaction.

Q.17 Silver metal crystallises with a face centred cubic lattice. The length of unit cell is found to be \( 4.077 \times 10^{-8} \) cm. Calculate atomic radius and density of silver.

(atomic mass of Ag = 108u, \( N_A = 6.02 \times 10^{23} \) mol\(^{-1}\))

Q.18 Calculate packing efficiency in ccp structure.
Q.19 Manu and his father went to a shop to purchase a battery for their inverter. Shopkeeper showed them two types of batteries, one with lead plates and the other with cadmium plates. The battery with cadmium plates was more expensive than the lead battery. They decided to purchase lead battery as it was cheaper.

After reading the above passage, answer the following questions:

a) As a student of chemistry, why would you suggest to Manu and his father to buy the expensive cadmium plate battery. Give two reasons.

b) Which two values will you be promoting through your suggestions?

Q.20 Give a reason for the following:

(i) Rough surface of catalyst is more effective than smooth surface.
(ii) Smoke passed through charged plates before allowing it to come out of chimneys in factories.
(iii) Ne gets easily absorbed over charcoal than He.

Q.21 (a) Give one example of each of the following:

(i) Acidic flux (ii) Basic flux

(b) What happens when:

(i) Cu₂O undergoes self reduction in a silica line converter. (ii) Haematite oxidises carbon to carbon monoxide.

OR

(a) What role does cryolite play in Hall Haraoult process?
(b) How can alumina be separated from silica in a bauxite ore associated with silica? Give equations also.

Q.22 Write balanced chemical equations for the following reactions.

(a) Hypophosphorous acid is added to AgNO₃ solution.
(b) Chlorine gas is passed through hot and concentrated solution of sodium hydroxide.
(c) XeF₂ undergoes hydrolysis.
Q.23  
(i) Draw the structure of sulphuric acid.  
(ii) A sparkless current is passed through oxygen to prepare ozone. Why?  
(iii) Bleaching action of sulphur is a temporary action. Comment.

Q.24  
(i) Give one structural difference between amylose and amylopectin  
(ii) Name the protein and its shape present in oxygen carrier in human body.  
(iii) Name two fat storing tissues in human body.

Q.25  
Define the following by giving one example of each:  
(i) Antiseptics  
(ii) Antioxidants  
(iii) Narcotic analgesics

Q.26  
(a) Write the names of the monomers of polymer used for making unbreakable crockery.  
(b) Write the reaction of preparation of neoprene.  
(c) Arrange the following polymers in decreasing order of intermolecular forces.  
   PVC, Nylon 66, Natural rubber.

Q.27  
Write the mechanism for preparation of ethanol from ethene.

Q.28  
(a) What is the freezing point of 0.4 molal solution of acetic acid in benzene in which it dimerises to the extent of 85%. Freezing point of benzene is 278.4\textdegree}C and its molar heat of fusion is 10.042kJ mol\(^{-1}\).
   (b) Explain the following:  
      (i) Solution of chloroform and acetone is an example of maximum boiling azeotrope.  
      (ii) A doctor advised a person suffering from high blood pressure to take less quantity of common salt.

   OR  
   (a) Calculate the boiling point of a solution containing 0.61g of benzoic acid in 5 g of CS\(_2\). Assuming 84% dimerisation of acid. The boiling point and K\(_b\) of CS\(_2\) are 46.2\(^\circ\)C and 2.3 K Kg mol\(^{-1}\) respectively.
   (b) State Raoult's law for the solution containing non-volatile solute. Give its mathematical expression also.

Q.29  
Account for the following:
(i) Transition elements show highest oxidation state in their oxides than fluorides.
(ii) Cu has positive electrode potential in the first transition series.
(iii) Ionisation enthalpy of lanthanides is higher than actinides.
(iv) Potassium dichromate is a good oxidising agent in acidic medium.
(v) Actinides show more number of oxidation states than lanthanides.

OR

(a) Compare non transition and transition elements on the basis of their
   (i) Variability of oxidation states (ii) stability of oxidation states.
(b) Give chemical reactions for the following observations:
   (i) Potassium permanganate is a good oxidising agent in basic medium.
   (ii) Inter convertibility of chromate ion and dichromate ion in aqueous solution depends upon pH of the solution.
   (iii) Potassium permanganate is thermally unstable at 513K.

Q.30. (a) Give names of the reagents to bring about the following transformations:
   i) Ethanoic acid to ethanol
   ii) Propane-1-ol to propanal
   iii) Pent-3-en-2-ol to pent-3-en-2-one
   iv) Sodium benzoate to benzene
(b) Arrange the following in the increasing order of:
   i) Methanal, Propanal, Butanone, Ethanal, Propanone (nucleophilic addition reaction)
   ii) Formaldehyde, Acetone, Acetaldehyde (reactivity towards HCN)
   iii) Acetophenone, p-tolualdehyde, p-nitrobenzaldehyde, Benzaldehyde (nucleophilic addition reaction)

OR

(a) Bring out the following conversions:
   (i) 4-nitrotoluene to 2-bromobenzoic acid.
   (ii) Ethylcyanide to 1-phenyl propanone.
(b) Give a reason for the following:
   (i) Chloroacetic acid is more acidic than acetic acid.
   (ii) Carboxylic acids have higher boiling point than alcohols.
   (iii) 4-nitrobenzoic acid is more acidic than 4-methoxy benzoic acid.
SAMPLE QUESTION PAPER
CHEMISTRY(043)
MARKING SCHEME

TIME ALLOTED : 3 Hrs

MAXIMUM MARKS: 70

1. Relatively large electron-electron repulsion among the lone pairs of \( F_2 \) molecule but they are much closer to each other in \( Cl_2 \) molecule. 1

2. 3,3-Di methyl-2-oxobutanoic acid. 1

3. Temperature and activation energy are inversely proportional to each other. 1

4. \( K_4[Fe(CN)_6] \) 1

5. \( CHO-(CHOH)_4CH_2OH + HI (excess) \xrightarrow{\Delta} n\text{-hexane (C}_6\text{H}_{14}) \) 1

6. XeF\(_6\) 1

7. Name is Ethylenediamine tetraacetate and denticity is 6. 1

8. Due to the presence of an alkyl group higher electron density is found on alkoxide ion. 1

9. (a) Kohlrausch law of independent migration of ions: The limiting molar conductivity of an electrolyte can be represented as the sum of the individual contribution of the anions and cations of the electrolyte.

(b) \[ \Lambda_m (CaSO_4) = \lambda_{Ca^{2+}}^0 + \lambda_{SO_4^{2-}}^0 = 119.0 \text{ S cm}^2\text{ mol}^{-1} + 106.0 \text{ S cm}^2\text{ mol}^{-1} \]

1/2

= 225.0 \text{ S cm}^2\text{ mol}^{-1} \quad \frac{1}{2} 1

10. \[
K = \frac{2.303}{t} \log \frac{a}{a-x} \quad \frac{1}{2}
\]

\[
t = \frac{2.303}{k} \log \frac{a}{a-x} \quad \frac{1}{2}
\]

[a = 1, x = \( \frac{3}{4} \)]

\[
t_{3/4} = \frac{2.303}{2.54 \times 10^3} \log \frac{1}{1-3/4} \quad \frac{1}{2}
\]

\[ t_{3/4} = 0.9066 \times 10^3 \times 0.6021 \]

176
\[ t_{3/4} = 5.46 \times 10^2 \text{ sec} \]

**OR**

\[ K = \frac{2.303}{t} \log \frac{a}{a-x} \]

\[ 2.0 \times 10^{-4} (\text{sec}^{-1}) = \frac{2.303}{900} \log \frac{a}{a-x} \]

\[
\log \frac{a}{a-x} = \frac{2.0 \times 10^{-4} \times 900}{2.303} = 0.0781 \\
\text{taking antilog} \frac{a}{a-x} = \text{antilog} (0.0781) = 1.197 \\
\frac{a}{a-x} = 1.197a - 1.197x \\
x = \frac{0.197a}{1.197} = 0.1645a
\]

Where \( a = 100 \), then \( x = 0.1645 \times 100 = 16.45 \) 
**i.e 16.45 % of initial concentration has changed into products.**

\[ \text{OMgBr} \quad \mid \quad \text{H}_3\text{O}^+ \quad \text{Cu} \quad \text{CH}_3\text{CHO} \quad \mid \quad \begin{array}{c} \text{CH}_3 \text{CHOH} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{COOH} \\ \text{573K} \end{array} \]

\[ \text{(CH}_3\text{)}_2\text{CO} \]

\[ \rightarrow \text{CH}_3\text{MgBr} + \text{CH}_3\text{CHO} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{Cl} + \text{KCN} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{CN} \]

\[ \text{(ii) C}_6\text{H}_5\text{CH}_2\text{OH} + \text{SOCl}_2 \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{Cl} + \text{KCN} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{CN} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{COOH} \]

12. (a) On heating chloroform and carbon tetrachloride with aniline and ethanolic potassium hydroxide separately chloroform forms pungent smelling isocyanide but carbon tetrachloride does not form this compound.

(b) On adding sodium hydroxide and silver nitrate to both the compounds benzyl chloride forms white precipitate but chlorobenzene does not form white precipitate.

13. (i) Order of reaction is zero.

(ii) units of rate constant is mol L$^{-1}$ s$^{-1}$

It has 5 unpaired electrons in 3d orbital which get paired leaving behind one unpaired electron only.

In $K_3[FeF_6]$ oxidation state of Fe is +3 and 5 unpaired electrons are there in 3d orbitals.

Because of the presence of different no. of unpaired electrons these impart different colour of same solution.

15.(i) Ortho toluidine is more basic than aniline due to the presence of electron releasing methyl group (+I effect) electron density at nitrogen of NH$_2$ in o-toluidine increases.

(ii) Due to the absence of replaceable hydrogen atom at nitrogen.

16.(i) Gabriel phthalimide reaction

(b) Hoffmann bromamide degradation reaction

$bR$-C-NH$_2$ + Br$_2$ + 4NaOH $\rightarrow$ R-NH$_2$ + Na$_2$CO$_3$ + 2NaBr + 2H$_2$O

17. Given $a = 4.077 \times 10^{-8}$ cm, $Z = 4$, $M = 108$ g mol$^{-1}$ $NA = 6.022 \times 10^{23}$

$$\frac{Z \times M}{a^3 \times NA}$$
19. a) Harmful effects of lead on the human being - as well as on the environment

It is wise to choose sustained long term benefit than short term gain with regard to health/money

Knowledge of chemistry and its relation to environment

b) (i) Environmental protection

(ii) Health concerns

20. (i) Rough surface of a catalyst provides more surface area for adsorption.

(ii) So that unburnt charged carbon particles get settled between the charged plate leaving behind air free from pollutants.

(iii) Ne has higher critical temperature i.e stronger vander waal's forces therefore easily adsorbed.
21 (a) Acidic flux is SiO$_2$  \[ \frac{1}{2} \]

Basic flux is CaO  \[ \frac{1}{2} \]

(b)

(i) Cu$_2$O undergoes self reduction to form blister copper as

\[
2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2
\]

(ii) Fe$_2$O$_3$ + 3C \[ \rightarrow 3\text{CO} + 2\text{Fe} \]

OR

(a) Cryolite reduces melting point of alumina .

(b) Concentration of ore is carried out by digesting the powdered ore with a concentrated solution of NaOH at 473-523 K and 35-36 bar pressure. Al$_2$O$_3$ is leached out as sodium meta aluminate and SiO$_2$ as sodium silicate leaving behind impurities.

\[
\text{Al}_2\text{O}_3(\text{s}) + 2\text{NaOH(aq)} + 3\text{H}_2\text{O} \rightarrow 2\text{Na}[\text{Al(OH)}_4]^{aq} \]

The resulting solution is filtered, cooled and neutralised by passing CO$_2$ gas through it. Then hydrated Al$_2$O$_3$ gets precipitated leaving sodium silicate in the solution.

\[
2\text{Na}[\text{Al(OH)}_4]^{aq} + \text{CO}_2(g) \rightarrow \text{Al}_2\text{O}_3.\text{xH}_2\text{O(s)} + 2\text{NaHCO}_3(aq)
\]

Sodium silicates remain in the solution and hydrated alumina is filtered, washed, dried and heated to get pure alumina (Al$_2$O$_3$).

\[
1470\text{K}
\]

\[
\text{Al}_2\text{O}_3.\text{xH}_2\text{O(s)} \rightarrow \text{Al}_2\text{O}_3(s) + \text{xH}_2\text{O(g)}
\]

22. (i) H$_3$PO$_3$ + 2AgNO$_3$ + H$_2$O \[ \rightarrow 2\text{Ag} + \text{HNO}_3 + 2\text{H}_3\text{PO}_4 \]

(ii) 3Cl$_2$ + 6 NaOH (conc.) \[ \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O} \]

(iii) 2XeF$_2$ + 2H$_2$O \[ \rightarrow 2\text{Xe} + \text{O}_2 + 4\text{H}^+ + 4\text{F}^- \]
23 (i) Since the formation of ozone from oxygen is endothermic reaction silent electric discharge prevents its decomposition.

(ii) Bleaching by sulphur dioxide is temporary because of its reducing nature.

24 (i) Amylose is a long unbranched chain polymer \( \alpha -D(\pm) \) glucose.

Amylopectin is a branched chain polymer of \( \alpha -D \) glucose.

(ii) Globular protein and its shape is spherical.

(iii) Liver and adipose tissue.

25. (i) Antiseptics are the chemicals applied to the living tissues either to kill or prevent the growth of microorganisms e.g dettol.

(ii) Antioxidants are the compounds which retard the action of oxygen on food and reduces its rate of decomposition by oxidation e.g BHA
(iii) Narcotic analgesics are the chemicals used for the relief of post operative pain, e.g., morphine.

26. (i) Monomers of the polymer are melamine and formaldehyde.

\[
\text{polymerisation}
\]

(ii) \(n \text{CH}_2=\text{C-CH}=\text{CH}_2 \rightarrow \left[ \text{CH}_2=\text{C-CH}-\text{CH}_2 \right]_n\)

(iii) Nylon66 > Natural rubber > PVC

27. 

Mechanism

The mechanism of the reaction involves the following three steps:

Step 1: Protonation of alkene to form carbocation by electrophilic attack of \(H_2O^+\).

\[\text{H}_2\text{O} + \text{H}^+ \rightarrow \text{H}_2\text{O}^+\]

\[\overset{\text{c}}{\text{C}} \overset{\text{c}}{\text{c}} + \text{H}^+ \overset{\text{O}}{\overset{\text{H}}{\text{H}}} \leftrightarrow \overset{\text{C}}{\text{C}} \overset{\text{c}}{\text{c}} + \text{H}_2\text{O}^+\]

Step 2: Nucleophilic attack of water on carbocation.

\[\overset{\text{h}}{\text{H}} \overset{\text{c}}{\text{C}} \overset{\text{c}}{\text{c}} + \text{H}_2\text{O} \rightarrow \overset{\text{c}}{\text{C}} - \overset{\text{c}}{\text{c}}\text{O}^+ - \text{H}\]

Step 3: Deprotonation to form an alcohol.

\[\overset{\text{h}}{\text{H}} \overset{\text{c}}{\text{C}} \overset{\text{c}}{\text{c}}\text{O}^+ - \text{H} + \text{H}_2\text{O} \rightarrow \overset{\text{h}}{\text{H}} \overset{\text{c}}{\text{c}}\text{O} + \text{H}_2\text{O}^+\]

28 : Given, \(m = 0.4\), \(T^0 = 278.4\), \(\Delta H_{\text{fus}} = 10.042 \text{ KJ mol}^{-1}\)

\[
RT_f^2M = 8.34 \times 10^3 \times (278.4)^2 \times 78
\]

\[
K_f = \frac{\text{RT}^2M}{(mT_f^2M)} = \frac{8.34 \times 10^3 \times (278.4)^2 \times 78}{0.4 \times (278.4)^2 \times 78} = 5.0 \text{ K Kg mol}^{-1}
\]
\[1000 \times \Delta H_{\text{fus}} = 1000 \times 10.042\]

\[2\text{CH}_3\text{COOH} \rightarrow (\text{CH}_3\text{COOH})_2\]

\[i - 1 \quad i - 1\]

\[\alpha = \_\_\_\_ = \_\_\_\_ \quad \frac{1}{2}\]

\[\frac{1}{n} - 1 \quad \frac{1}{2}\]

\[i - 1\]

\[= \_\_\_\_ = 0.85 \quad \frac{1}{2} - 1\]

\[= i - 1 = -0.425 \quad \frac{1}{2}\]

\[i = 0.575\]

\[\Delta T_f = I K_f m = 0.575 \times 5 \times 0.4 = 1.15\]

\[T_f = T_f^0 - \Delta T_f = 278.4 - 1.15 = 277.25 \text{ K} \quad \frac{1}{2} + 1/2\]

(b) i) This solution has lesser vapour pressure due to stronger interactions between chloroform and acetone molecules.

ii) Because higher quantity of NaCl will increase no. of sodium and chloride ions in the body fluid which can increase the osmotic pressure of body fluid i.e blood pressure of a person.

OR

\[2\text{C}_6\text{H}_5\text{COOH} \rightarrow (\text{C}_6\text{H}_5\text{COOH})_2\]
\[ \alpha = \frac{1}{n - 1} = 0.84 = \frac{1}{2} + \frac{1}{2} \]
\[ 0.84 \]
\[ i = 1 - \frac{\alpha}{0.42} = 0.58 \]

Normal molar mass of benzoic acid = 122 g mol\(^{-1}\)

\[ \Delta T_b = i.K_b \cdot m = 0.58 \times 2.3 \times 0.1 = 0.1334^\circ C \]
\[ T_b = T_b^0 + \Delta T_b = 46.2^\circ C + 0.1334^\circ C = 46.334^\circ C \]

(b) Raoult’s law: The relative lowering of vapour pressure of the solvent over a solution is equal to the mol fraction of non-volatile solute present in the solution.

Mathematical expression

\[ \chi_B = \frac{P_0^1 - P_1}{P_0^1} \]

29. (i) Because oxygen forms multiple bonds with transition metals but fluorine does not form multiple bonds.

(ii) Cu has lower hydration enthalpy which is unable to compensate sum of first and second ionisation enthalpy.

(iii) 4f electrons of lanthanides is less effectively shielded by nuclear charge than 5f electrons of actinides.

(iv) Because dichromate ions get reduced to chromium ions in acidic medium.

(v) The actinides show more number of oxidation states than lanthanides because in actinides 5f, 6d and 7s levels have comparable energies.

OR
(i) Oxidation states of transition elements differ from each other by unity. In non transition elements oxidation states normally differ by a unit of two. 

\[ \frac{1}{2} + \frac{1}{2} \]

(ii) In transition elements higher oxidation states are favoured by heavier elements whereas in non transition elements lower oxidation state is favoured by transition elements. 

\[ \frac{1}{2} + \frac{1}{2} \]

(b) i) \[ 2 \text{MnO}_4^- + \text{H}_2\text{O} + \text{I}^- \rightarrow 2\text{MnO}_2 + 2\text{OH}^- + \text{IO}_3^- \]

Acid (pH less than 7)

(ii) \[ 2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + 2\text{H}_2\text{O} \]

Alkali (pH more than 7)

\[ \Delta 513 \text{K} \]

(iii) \[ 2 \text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2 \]

30. (a) (i) \( \text{LiAlH}_4/\text{H}_3\text{O}^+ \)

(ii) PCC

(iii) PCC

(iv) sodalime

(b) (i) Butanone < Propanone < Propanal < Ethanal < Methanal.

(ii) Acetone < Acetaldehyde < Formaldehyde.

(iii) Acetophenone < p-Tolualdehyde < Benzaldehyde < p-Nitro benzaldehyde.

OR

(a) (i)
(b) (i) Because chloroacetate ion is more resonance stabilised than acetate ion due to the presence of electron withdrawing chlorine atom (+I effect).

(ii) Due to the presence of extensive intermolecular hydrogen bonding in carboxylic acids than in alcohols molecules.

(iii) Because of –I effect of nitro group stability of benzoate ion increases in 4-nitro benzoic acid.

But methoxy (+I effect) group decreases the stability of benzoate ion.