

SAMPLE CONTENT



SOLUTIONS TO **HSC** **BOARD** QUESTION BANK

Based on Question Bank released by
SCERT Maharashtra

• **PHYSICS** • **CHEMISTRY** • **MATHEMATICS**
• **BIOLOGY** • **ENGLISH**

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SOLUTIONS TO HSC BOARD QUESTION BANK

Salient Features

- Covers solutions to the Entire Question Bank of Std. XII released by State Council of Educational Research and Training, Maharashtra in the March 2021
- Questions from reduced syllabus (2021-22) are marked with symbol **R**
- Includes English Yuvakbharati, Physics, Chemistry, Mathematics & Statistics (1 & 2) and Biology
- Answers framed for all questions are based on Government Textbook and as per the prescribed marking scheme

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PREFACE

The Question Bank for Std. XII was released by State Council of Educational Research and Training, Maharashtra in the month of March 2021 as a respite to all the HSC students whose education had suffered due to the ongoing pandemic & the resultant restrictions at that point of time. The board exam for the year 2021 couldn't be conducted due to the pandemic but the question bank released by the Board remains a guiding light for all the students who will be appearing for the board exam in the year 2022 and the further years as well.

Target's '**Solutions to HSC Board Question Bank**' is intended for every state board student of standard XII. As the name suggests, the book includes the solutions to each and every question that was provided in the question bank. The book encompasses all the question types as per the given sequence in the question bank for each subject, that is, for English Yuvakbharati, Physics, Chemistry, Mathematics & Statistics (1 & 2) and Biology. Keeping in the mind syllabus reduced for the academic year 2021-22, questions belonging to the reduced syllabus are marked with symbol **R**.

The answers framed in the book are completely based on the Government Textbook. At certain points, we have simplified or modified the answers for the ease of understanding. We have ensured that the answers are as per the prescribed marking scheme so that the student's efforts bear the desired fruits.

To aid students, hints are provided for questions wherever deemed necessary.

We hope that the students find the book as one stop solution to the Question Bank .

- Publisher

Edition: First

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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A book affects eternity; one can never tell where its influence stops

Disclaimer

This reference book is transformative work based on Solutions to '**HSC Board Question Bank (2020-21)**' for English Yuvakbharati, Physics, Chemistry, Mathematics & Statistics (1 & 2) and Biology released by State Council of Educational Research and Training, Maharashtra. We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

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Q.1. Read the extract and complete the activities given below: [12 Marks]

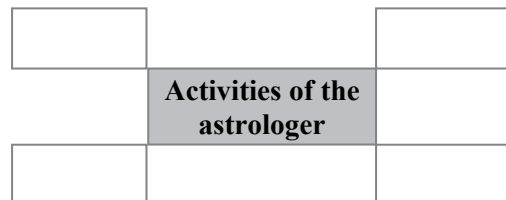
Punctually at midday he opened his bag and spread out his professional equipment, which consisted of a dozen cowrie shells, a square piece of cloth with obscure mystic charts on it, a notebook, and a bundle of Palmyra writing. His forehead was resplendent (glorious) with sacred ash and vermilion, and his eyes sparkled with a sharp abnormal gleam (shine) which was really an outcome of a continual searching look for customers, but which his simple clients took to be a prophetic light and felt comforted. The power of his eyes was considerably enhanced by their position placed as they were between the painted forehead and the dark whiskers (mustaches) which streamed down his cheeks: even a half-wit's eyes would sparkle in such a setting. To crown the effect he wound a saffron-coloured turban around his head. This colour scheme never failed. People were attracted to him as bees are attracted to cosmos or dahlia stalks. He sat under the boughs of a spreading tamarind tree which flanked a path running through the Town Hall Park. It was a remarkable place in many ways. A surging crowd was always moving up and down this narrow road from morning till night. A variety of trades and occupations was represented all along its way: medicine sellers, sellers of stolen hardware and junk, magicians, and above all, an auctioneer of cheap cloth, who created enough din all day to attract the whole town. Next to him in vociferousness came a vendor of fried groundnut, who gave his ware a fancy name each day, calling it "Bombay Ice Cream" one day and on the next "Delhi Almond," and on the third "Raja's Delicacy," and so on and so forth, and people flocked to him. A considerable portion of this crowd dallied before the astrologer too. The astrologer transacted his business by the light of a flare which crackled and smoked up above the groundnut heap nearby. Half the enchantment of the place was due to the fact that it did not have the benefit of municipal lighting. The place was lit up by shop lights. One or two had hissing gaslights, some had naked flares stuck on poles, some were lit up by old cycle lamps, and one or two, like the astrologer, managed without lights of their own. It was a bewildering crisscross of light rays and moving shadows. This suited the astrologer very well, for the simple reason that he had not in the least intended to be an astrologer when he began life; and he knew no more of what

was going to happen to others than he knew what was going to happen to himself next minute. He was as much a stranger to the stars as were his innocent customers. Yet he said things which pleased and astonished everyone: that was more a matter of study, practice, and shrewd guesswork. All the same, it was as much an honest man's labour as any other, and he deserved the wages he carried home at the end of a day.

A1. State if the given statements are True or False. (2)

- The astrologer used to have the preparation of his business in quite professional way.
- The physical appearance of the astrologer hardly created an impact on the customers.
- The place was busy with a variety of occupations.
- The astrologer's style of handling the business lies in his skills.

Ans: i. True ii. False
iii. True iv. True

A2. Complete the given web. (2)**Ans:**

Open his bag and spread out his professional equipment punctually at midday.

Enhance his physical appearance by applying sacred ash and vermilion on his forehead and adorn a saffron turban around his head.

Activities of the astrologer

Say things which pleased and astonished everyone.

Transact his business by the light of a flare which crackled and smoked up above the groundnut heap nearby.

A3. The astrologer was a shrewd judge of a character. Explain with some details from the extract. (2)

Ans: The astrologer was very good at figuring out people. He used to enhance his face by



applying sacred ash and vermilion. He knew this colour scheme would attract the people. He also worked near the groundnut vendor intentionally because he knew the huge crowd around the peanut vendor would someday dally towards him. The place where he sat had minimal lighting and crisscross of lights streaming in. This gave his place a mysterious aura which is needed for an astrologer. He said things which would please and astonish the crowd. So the choice of his appearance and words coupled with the location proves that the astrologer was a shrewd judge of character.

A4. We need to understand even the smallest details of the business in order to succeed. Write your views. (2)

Ans: Business is not everyone's cup of tea. It involves many process like marketing, production and sales. One needs to understand every intricate detail about their business in order to be a successful businessman. Imagine being CEO of a Smartphone brand, but not been able to explain how your mobile is developed during an interview will surely show you in poor light. Every aspiring entrepreneur should remember that 'the devil is in the details'.

A5. Do as directed. (2)

- i. It was a remarkable place in many ways.
(Choose correct alternative to rewrite the given sentence as an exclamatory sentence)
- It was a remarkable place in many ways!
 - How a remarkable place in many ways it was!
 - What a remarkable place in many ways it was!
 - What remarkable in many ways the place it was!

Ans: c. What a remarkable place in many ways it was!

- ii. He spread out his professional equipment, which consisted of a dozen cowrie shells.
(Choose correct alternative to rewrite the given sentence as a compound sentence)

- He spread out his professional equipment but it consisted of a dozen cowrie shells.
- He spread out his professional equipment and it consisted of a dozen cowrie shells.

- He spread out his professional equipment that it consisted of a dozen cowrie shells.
- He spread out his professional equipment and it had consisted of a dozen cowrie shells.

Ans: b. He spread out his professional equipment and it consisted of a dozen cowries shells.

A6. Find the synonyms for the following words from the passage. (2)

- Confusing
- Hanging around
- Difficult to understand
- Magical effect

Ans: i. Bewildering ii. Dallied
iii. Obscure iv. Enchantment

Q.2. Read the extract and complete the activities given below: [12 Marks]

The young lift-man in a City office who threw a passenger out of his lift the other morning and was fined for the offence was undoubtedly in the wrong. It was a question of "Please." The complainant entering the lift, said, "Top." The lift-man demanded "Top-please," and this concession being refused he not only declined to comply with the instruction, but hurled the passenger out of the lift. This, of course was carrying a comment on manner too far. Discourtesy is not a legal offence, and it does not excuse assault and battery. If a burglar breaks into my house and I knock him down, the law will acquit me, and if I am physically assaulted, it will permit me to retaliate with reasonable violence. It does this because the burglar and my assailant have broken quite definite commands of the law. But no legal system could attempt to legislate against bad manners or could sanction the use of violence against something which it does not itself recognize as a legally punishable offence. And our sympathy with the liftman, we must admit that the law is reasonable. It would never do if we were at liberty to box people's ears because we did not like their behaviour, or the tone of their voices, or the scowl on their faces. Our fists would never be idle, and the gutters of the city would run with blood all day. I may be as uncivil as I may please and the law will protect me against violent retaliation. I may be haughty or boorish and there is no penalty to pay except the penalty of being written down an illmannered fellow. The law does not compel me to say "Please" or to attune my voice to other people's sensibilities any more than it says that I shall not wax my moustache or dye my hair or wear ringlets down my back. It does not

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Note: The $\text{\textcircled{R}}$ marked questions are the part of reduced/non-evaluative portion for academic year 2020-21 only.

Multiple Choice Questions (1 Mark Each)

- A diver in a swimming pool bends his head before diving. It
 - Increases his linear velocity
 - Decreases his angular velocity
 - Increases his moment of inertia
 - Decreases his moment of inertia
- The angular momentum of a system of particles is conserved
 - When no external force acts upon the system
 - When no external torque acts upon the system
 - When no external impulse acts upon the system
 - When axis of rotation remains the same
- A stone is tied to one end of a string. Holding the other end, the string is whirled in a horizontal plane with progressively increasing speed. It breaks at some speed because
 - Gravitational forces of the earth is greater than the tension in string
 - The required centripetal force is greater than the tension sustained by the string
 - The required centripetal force is lesser than the tension in the string
 - The centripetal force is greater than the weight of the stone
- The moment of inertia of a circular loop of radius R , at a distance of $R/2$ around a rotating axis parallel to horizontal diameter of the loop is

(A) $\frac{1}{2} MR^2$	(B) $\frac{3}{4} MR^2$
(C) MR^2	(D) $2 MR^2$
- A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/hr. The centripetal force is

(A) 250 N	(B) 750 N
(C) 1000 N	(D) 1200 N
- A cyclist riding a bicycle at a speed of $14\sqrt{3}$ m/s takes a turn around a circular road of radius $20\sqrt{3}$ m without skidding. Given $g = 9.8 \text{ m/s}^2$, what is his inclination to the vertical?

(A) 30°	(B) 45°
(C) 60°	(D) 90°
- A string of length ℓ fixed at one end carries a mass m at the other. The string makes $2/\pi$ revolutions/sec around the vertical axis through the fixed end. The tension in the string is

(A) $2 m\ell$	(B) $4 m\ell$
(C) $8 m\ell$	(D) $16 m\ell$

Answers:

1. (D) 2. (B) 3. (B) 4. (B)
5. (C) 6. (C) 7. (D)

Hints:

$$4. \quad I_0 = I_c + Mh^2$$

$$= \frac{MR^2}{2} + M\left(\frac{R}{2}\right)^2$$

....(M.I. of circular loop along its diameter = $\frac{MR^2}{2}$)

$$= \frac{MR^2}{2} + \frac{MR^2}{4} = \frac{3}{4} MR^2$$

$$5. \quad \text{C.P.F.} = \frac{mv^2}{r} = \frac{500 \times 10^2}{50} = 1000 \text{ N}$$

$$6. \quad \theta = \tan^{-1}\left(\frac{v^2}{rg}\right) = \tan^{-1}\left(\frac{14 \times 14 \times 3}{20 \times \sqrt{3} \times 9.8}\right) = \tan^{-1}(\sqrt{3})$$

$$\therefore \theta = 60^\circ$$

$$7. \quad \omega = 2\pi r = 2\pi \times \frac{2}{\pi} = 4 \text{ rad/s}$$

$$T = m/\omega^2 = 16 m\ell$$

Very Short Answer (VSA)(1 Mark Each)

- Find the radius of gyration of a uniform disc about an axis perpendicular to its plane and passing through its centre.

Ans: M.I. of a uniform disc about an axis perpendicular to the plane and passing through

$$\text{its centre: } I = \frac{MR^2}{2}$$

$$\text{Since, } I = MK^2$$

$$K = \sqrt{\frac{I}{M}} = \sqrt{\frac{MR^2}{2M}} = \frac{R}{\sqrt{2}}$$

- Does the angle of banking depend on the mass of the vehicle?

Ans: No, angle of banking is independent of mass of the vehicle.



3. During ice ballet, while in the outer rounds, why do the dancers outstretch their arms and legs.

Ans: During ice ballet, while in the outer rounds, the dancers outstretch their arms and legs to reduce their angular speed.

4. State the principle of conservation of angular momentum.

Ans: Angular momentum of an isolated system is conserved in the absence of an external unbalanced torque.

5. Two bodies have their moments of inertia I and $2I$ respectively about their axis of rotation. If their kinetic energies of rotation are equal, then what is the ratio of their angular velocity?

Ans: Given: $(K.E.)_1 = (K.E.)_2$

$$\therefore \frac{1}{2}I_1\omega_1^2 = \frac{1}{2}I_2\omega_2^2$$

$$\therefore \frac{\omega_1}{\omega_2} = \sqrt{\frac{I_2}{I_1}}$$

$$= \sqrt{\frac{2I}{I}} \quad \dots (\text{Given: } I_1 = I, I_2 = 2I)$$

$$\frac{\omega_1}{\omega_2} = \frac{\sqrt{2}}{1}$$

$$\therefore \omega_1 : \omega_2 = \sqrt{2} : 1$$

6. A hollow sphere has radius 6.4 m. what is the minimum velocity required by a motor cyclist at bottom to complete the circle.

Ans: Minimum velocity required by a motor cyclist at bottom to complete the circle,

$$v_{\min} = \sqrt{5rg} = \sqrt{5 \times 6.4 \times 9.8} = 17.7 \text{ m/s}$$

7. A bend in a level road has a radius of 100 m. Find the maximum speed which a car turning this bend may have without skidding, if the coefficient of friction between the tyres and road is 0.8.

Ans: Maximum speed, which a car turning the bend may have without skidding,

$$v_{\max} = \sqrt{\mu rg}$$

$$= \sqrt{0.8 \times 100 \times 9.8}$$

$$= 28 \text{ m/s}$$

Short Answer I (SA1) (2 Marks Each)

1. A flywheel is revolving with a constant angular velocity. A chip of its rim breaks and flies away. What will be the effect on its angular velocity?

Ans:

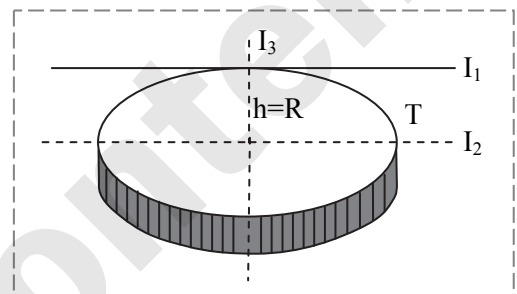
- i. When the chip of the rim of a flywheel revolving with a constant angular velocity breaks away, its mass will decrease.

- ii. Due to the decrease in its mass, the moment of inertia of the flywheel will decrease.
- iii. In order to conserve angular momentum, the angular velocity of the flywheel will increase.

2. The moment of inertia of a uniform circular disc about a tangent in its own plane is $\frac{5}{4}MR^2$ where M is the mass and R is the radius of the disc. Find its moment of inertia about an axis through its centre and perpendicular to its plane.

Ans:

- i. M.I. of a uniform circular disc about a tangent in its own plane, $I_1 = \frac{5}{4}MR^2$



- ii. Applying parallel axis theorem

$$I_1 = I_2 + Mh^2$$

$$\therefore I_2 = I_1 - MR^2 = \frac{5}{4}MR^2 - MR^2 = \frac{MR^2}{4}$$

- iii. Applying perpendicular axis theorem,

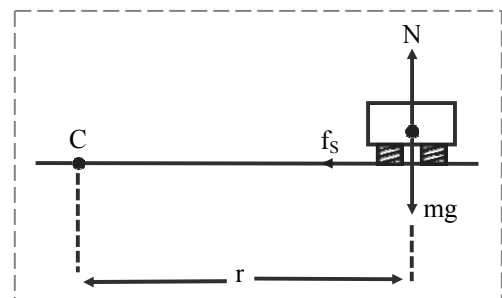
$$I_3 = I_2 + I_2 = 2I_2$$

$$\therefore I_3 = 2 \times \frac{MR^2}{4} = \frac{MR^2}{2}$$

3. Derive an expression for maximum safety speed with which a vehicle should move along a curved horizontal road. State the significance of it.

Ans:

- i. Consider vertical section of a car moving on a horizontal circular track having a radius 'r' with 'C' as centre of track.



- ii. Forces acting on the car (considered to be a particle):

- a. Weight (mg), vertically downwards,
- b. Normal reaction (N), vertically upwards that balances the weight

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01 Solid State

Note: The $\text{\textcircled{R}}$ marked questions are the part of reduced/non-evaluative portion for academic year 2020-21 only.

Multiple Choice Questions (1 Mark)

- The following types of solids contain molecules as constituent particles?
(A) molecular solids
(B) ionic solids
(C) metallic solids
(D) covalent network solids
 - The following crystal systems contain 4 Bravais lattices?
(A) cubic (B) tetragonal
(C) orthorhombic (D) monoclinic
 - An octahedral void is surrounded by _____.
(A) 4 spheres (B) 3 spheres
(C) 8 spheres (D) 6 spheres
 - $\text{\textcircled{R}}$ Which of the following is an amorphous solid?
(A) Copper sulphate (B) Magnesium
(C) Tar (C) Diamond
 - A paired cation-anion vacancy is called _____.
(A) Schottky defect
(B) Frenkel defect
(C) impurity defect
(D) vacancy defect
 - The unit cell of a simple cubic system has atoms at the eight corners. Hence, number of atoms in an unit cell is _____.
(A) 8 (B) 3 (C) 1 (D) 2
 - In crystal lattice formed by primitive cubic unit cell, the space occupied by particles is _____.
(A) 47.6% (B) 52.4%
(C) 32% (C) 68%
- [Note: The question statement is modified by including the term 'cubic'.]
- The coordination number of spheres in hcp lattice in three dimension is _____.
(A) 2 (B) 6 (C) 4 (D) 12
 - A compound is made up of two elements X and Y and crystallizes in bcc structure. Atoms of X are present at the corners of the cube. Atoms of Y are present at the centre of the cube. The formula of the compound is _____.
(A) X_2Y (B) XY
(C) XY_2 (D) X_2Y_3

- Sodium crystallizes in bcc structure. If the edge length of unit cell is 4.3×10^{-8} cm, the radius of Na atom is _____.
(A) 1.86×10^{-8} cm (B) 1.52×10^{-8} cm
(C) 2.15×10^{-8} cm (D) 4.3×10^{-8} cm

Answers:

- (A) 2. (C) 3. (D) 4. (C)
5. (A) 6. (C) 7. (B) 8. (D)
9. (B) 10. (A)

Hint:

- For bcc unit cell, $r = \frac{\sqrt{3}a}{4}$
 $= \frac{1.732 \times 4.3 \times 10^{-8}}{4}$
 $= 1.86 \times 10^{-8}$ cm

Very Short Answer Questions (1 Mark)

- Write the effect on density of a substance in the Frenkel defect?**

Ans: In the Frenkel defect, the density of the substance remains unchanged. As no ions are missing from the crystal lattice as a whole.

- Name the bravais lattice in the triclinic system.**

Ans: The Bravais lattice in the triclinic system is simple or primitive unit cell.

- What are diamagnetic substances?**

Ans: The substances with all electrons paired, are weakly repelled by magnetic fields. Such substances are called as **diamagnetic substances**.

- Give one property common to both hcp and ccp crystal lattices.**

Ans: One property common to both hcp and ccp lattice is same coordination number of the particles (i.e., 12).

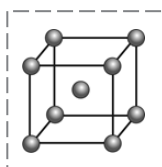
- $\text{\textcircled{R}}$ **Write the relationship between radius of atom and edge length of fcc unit cell.**

Ans: For fcc unit cell, radius of atom

$$r = \frac{\text{Edge length (a)}}{2\sqrt{2}}$$

- Draw diagram of bcc unit cell.**

Ans: bcc unit cell:





7. The number of tetrahedral voids are formed if the number of atoms in a crystal is $N/2$.

Ans: If the number of atoms in a crystal is $N/2$, the number of tetrahedral voids is N .

8. Give the percentage of empty space in bcc lattice.

Ans: The percentage of empty space in bcc lattice is 32%.

9. If the total volume of a simple cubic unit cell is $6.817 \times 10^{-23} \text{ cm}^3$, what is the volume occupied by particles in unit cell?

Ans: Volume occupied by particles in simple cubic unit cell

$$= \frac{\pi a^3}{6} = \frac{3.14 \times 6.817 \times 10^{-23} \text{ cm}^3}{6}$$

$$= 3.57 \times 10^{-23} \text{ cm}^3$$

10. The number of octahedral voids formed in 0.5 mol of a compound forming hcp structure?

Ans: Number of particles in 0.5 mol

$$= 0.5 \times N_A$$

$$= 0.5 \times 6.022 \times 10^{23}$$

$$= 3.011 \times 10^{23}$$

\therefore Number of octahedral voids
= Number of particles
= 3.011×10^{23}

Short Answer Questions (Type-I) (2 Marks)

1. Distinguish between crystalline solids and amorphous solids.

Ans:

	Crystalline solids	Amorphous solids
i.	The constituent particles are arranged in a regular and periodic manner.	The constituent particles are arranged randomly.
ii.	They have sharp and characteristic melting point.	They do not have sharp melting point. They gradually soften over a range of temperature.
iii.	They are anisotropic, i.e., have different physical properties in different direction.	They are isotropic, i.e., have same physical properties in all directions.
iv.	They have long range order.	They have only short range order.
e.g.	Ice, NaCl	Glass, rubber, plastics, etc.

2. Classify the following solids as molecular, ionic, covalent and metallic solids.
Pb, MgF_2 , SO_2 and quartz

Ans:

- Pb – Metallic solid
- MgF_2 – Ionic solid
- SO_2 – Molecular solid
- Quartz – Covalent solid

3. Find the number of atoms in the fcc unit cell.

Ans:

i. A face-centred cubic (fcc) unit cell has particles at the eight corners plus particles at the centre of its six faces.

ii. Each particle present at the corner of a given unit cell is shared with seven other neighbouring unit cells. As a result, its contribution to the given unit cell is only $\frac{1}{8}$.

Thus, the number of particles present at corners per unit cell = 8 corner atoms $\times \frac{1}{8}$ atom per unit cell = 1

iii. Each particle at the centre of the six faces is shared with one neighbouring cube. Thus, 1/2 of each face particle belongs to the given unit cell. Thus, the number of particles present at faces per unit cell = 6 atoms at the faces $\times \frac{1}{2}$ atom

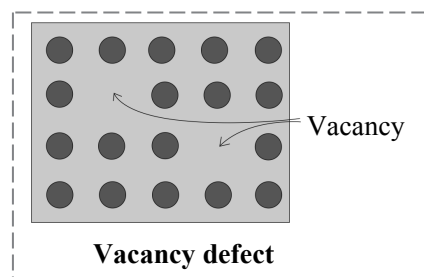
per unit cell = 3

Therefore, fcc unit cell has one corner particle plus 3 face particles, making **total of 4 particles per unit cell.**

4. Explain with diagram, the vacancy defect.

Ans: Vacancy defect:

- During crystallization of a solid, a particle is missing from its regular site in the crystal lattice.
- The missing particle creates a vacancy in the lattice structure. Thus, some of the lattice sites are vacant because of missing particles as shown in the figure. Such a crystal is said to have a vacancy defect.
- The vacancy defect can also be developed when the substance is heated.
- Due to the absence of particles, the mass of the substance decreases. However, the volume remains unchanged. As a result, the density of the substance decreases.



Page no. **177** to **258** are purposely left blank.

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I. Select and write the most appropriate answer from the given alternatives:

- Which of the following statement is true
(A) $3 + 7 = 4$ or $3 - 7 = 4$
(B) If Pune is in Maharashtra, then Hyderabad is in Kerala
(C) It is false that 12 is not divisible by 3
(D) The square of any odd integer is even.
- Which of the following is not a statement
(A) $2 + 2 = 4$
(B) 2 is the only even prime number
(C) Come here
(D) Mumbai is not in Maharashtra
- If p is any statement then $(p \vee \sim p)$ is a
(A) Contingency (B) Contradiction
(C) Tautology (D) None of these
- If p and q are two statements, then $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is
(A) Contradiction (B) Tautology
(C) Neither (i) nor (ii) (D) None of these
- Negation of $p \rightarrow (p \vee \sim q)$ is
(A) $\sim p \rightarrow (\sim p \vee q)$ (B) $p \wedge (\sim p \wedge q)$
(C) $\sim p \vee (\sim p \vee \sim q)$ (D) $\sim p \rightarrow (\sim p \rightarrow q)$
- If p : He is intelligent
 q : He is strong
Then, symbolic form of statement "It is wrong that, he is intelligent or strong" is
(A) $\sim p \vee \sim q$ (B) $\sim(p \wedge q)$
(C) $\sim(p \vee q)$ (D) $p \vee \sim q$
- A biconditional statement is the conjunction of two _____ statements
(A) Negative (B) Compound
(C) Connective (D) Conditional
- If $p \rightarrow q$ is an implication, then the implication $\sim q \rightarrow \sim p$ is called its
(A) Converse (B) Contrapositive
(C) Inverse (D) Alternative
- The negation of the statement $(p \wedge q) \rightarrow (r \vee \sim p)$ is
(A) $p \wedge q \wedge \sim r$ (B) $(p \wedge q) \vee r$
(C) $p \vee q \vee \sim r$ (D) $(p \vee q) \wedge (r \vee s)$
- The false statement in the following is
(A) $p \wedge (\sim p)$ is contradiction
(B) $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a contradiction
(C) $\sim(\sim p) \leftrightarrow p$ is a tautology
(D) $p \vee (\sim p)$ is a tautology

Answers:

1. (C) 2. (C) 3. (C) 4. (B)
5. (B) 6. (C) 7. (D) 8. (B)
9. (A) 10. (B)

Hints:

- Note that 12 is divisible by 3.
 \therefore The statement '12 is not divisible by 3' is wrong.
 \therefore The truth value of the statement 'It is false that 12 is not divisible by 3.' is true.
- Sentence given in option (C) is an imperative sentence. Hence, it can not be a statement.

3.

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

- $(p \vee \sim p)$ is a tautology
- $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$
Note that ' $\sim q \rightarrow \sim p$ ' is contrapositive of the statement ' $p \rightarrow q$ '
A conditional statement and its contrapositive are always equivalent.
Hence, $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is tautology.
- Negation of $p \rightarrow q$ is $p \wedge \sim q$
 $\therefore \sim[p \rightarrow (p \vee \sim q)] \equiv p \wedge \sim(p \vee \sim q)$
 $\equiv p \wedge (\sim p \wedge q)$
...[De-Morgan's Law]
- The symbolic form of statement 'He is intelligent or strong' is $p \vee q$.
 \therefore The symbolic form of the given statement is $\sim(p \vee q)$.
- Consider a biconditional statement $p \leftrightarrow q$
 $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
i.e., conjunction of two conditional statements.
- Negation of $p \rightarrow q \equiv p \wedge \sim q$
 $\therefore \sim[(p \wedge q) \rightarrow (r \vee \sim p)]$
 $\equiv (p \wedge q) \wedge \sim(r \vee \sim p)$
 $\equiv (p \wedge q) \wedge (\sim r \wedge p)$
 $\equiv p \wedge q \wedge \sim r$...[Idempotent Law]
- Consider, $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$
Note that ' $\sim q \rightarrow \sim p$ ' is contrapositive of the statement ' $p \rightarrow q$ '
A conditional statement and its contrapositive are always equivalent.
Hence, $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is tautology.
 \therefore Statement in option (B) is false.

[Note: Option (D) has been modified.]



II. Attempt the following (1 Mark)

1. Find the negation of $10 + 20 = 30$.

Solution:

Negation of ' $10 + 20 = 30$ ' is ' $10 + 20 \neq 30$ '.

2. State the truth Value of $x^2 = 25$.

Solution:

' $x^2 = 25$ ' is an open sentence.

It is not a statement in logic.

3. Write the negation of $p \rightarrow q$.

Solution:

$$\begin{aligned}\sim(p \rightarrow q) &\equiv \sim(\sim p \vee q) \quad \dots [\because p \rightarrow q \equiv \sim p \vee q] \\ &\equiv \sim(\sim p) \wedge \sim q \quad \dots [\text{De'Morgan's Law}] \\ &\equiv p \wedge \sim q\end{aligned}$$

4. State the truth value of $\sqrt{3}$ is not an irrational number.

Solution:

Let p : $\sqrt{3}$ is irrational number.

\therefore Truth value of p is T.

$\therefore \sim p$: $\sqrt{3}$ is not an irrational number.

\therefore Truth value of $\sim p$ is F.

5. State the truth value of $(p \vee \sim p)$.

Solution:

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

\therefore Truth value of $(p \vee \sim p)$ is T.

6. State the truth value of $(p \wedge \sim p)$.

Solution:

p	$\sim p$	$p \wedge \sim p$
T	F	F
F	T	F

\therefore Truth value of $(p \wedge \sim p)$ is F.

III. Attempt the following (2 Marks)

1. If statements p , q are true and r , s are false, determine the truth values of the following.

i. $\sim p \wedge (q \vee \sim r)$

ii. $(p \wedge \sim r) \wedge (\sim q \vee s)$

Solution:

i. $\sim p \wedge (q \vee \sim r)$

$$\equiv \sim T \wedge (T \vee \sim F)$$

$$\equiv F \wedge (T \vee T)$$

$$\equiv F \wedge T$$

$$\equiv F$$

Truth value of $\sim p \wedge (q \vee \sim r)$ is F

ii. $(p \wedge \sim r) \wedge (\sim q \vee s)$

$$\equiv (T \wedge \sim F) \wedge (\sim T \vee F)$$

$$\equiv (T \wedge T) \wedge (F \vee F)$$

$$\equiv T \wedge F$$

$$\equiv F$$

\therefore Truth value of $(p \wedge \sim r) \wedge (\sim q \vee s)$ is F.

2. Write the following compound statements symbolically.

- i. Nagpur is in Maharashtra and Chennai is in Tamilnadu.

- ii. Triangle is equilateral or isosceles.

Solution:

- i. Let p : Nagpur is in Maharashtra.

q : Chennai is in Tamilnadu.

The symbolic form is $p \wedge q$.

- ii. Let p : Triangle is equilateral.

q : Triangle is isosceles.

The symbolic form is $p \vee q$.

3. Write the converse and contrapositive of the following statement.

"If a function is differentiable then it is continuous".

Solution:

Let p : A function is differentiable,

q : A function is continuous.

\therefore The symbolic form of the given statement is $p \rightarrow q$.

Converse: $q \rightarrow p$

i.e. If a function is continuous then it is differentiable.

Contrapositive: $\sim q \rightarrow \sim p$

i.e. If a function is not continuous then it is not differentiable.

4. Without using truth table prove that :

$$\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$$

Solution:

$$\sim(p \vee q) \vee (\sim p \wedge q)$$

$$\equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q) \quad \dots [\text{De Morgan's Law}]$$

$$\equiv \sim p \wedge (\sim q \vee q) \quad \dots [\text{Distributive Law}]$$

$$\equiv \sim p \wedge T \quad \dots [\text{Complement Law}]$$

$$\equiv \sim p \quad \dots [\text{Identity Law}]$$

IV. Answer the following questions

1. Write the negation of the statement "An angle is a right angle if and only if it is of measure 90° ".

Solution:

Let p : An angle is a right angle.

q : An angle is of measure 90° .

\therefore The symbolic form of the above Statement is $p \leftrightarrow q$.

Note that negation of ' $p \leftrightarrow q$ ' is $(p \wedge \sim q) \vee (q \wedge \sim p)$.

\therefore The negation of the given statement is 'An angle is a right angle and it is not of measure 90° or an angle is of measure 90° and it is not a right angle.

2. Write the following statements in symbolic form

- i. Milk is white if and only if the sky is not blue

- ii. If Qutab – Minar is in Delhi then Taj- Mahal is in Agra

- iii. Even though it is not cloudy, it is still raining

Page no. **261** to **324** are purposely left blank.

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01 Differentiation

Multiple Choice Questions (2 Marks)

- If $y = \sec(\tan^{-1} x)$, then $\frac{dy}{dx}$ at $x = 1$ is _____.
 (A) $\frac{1}{2}$ (B) 1
 (C) $\frac{1}{\sqrt{2}}$ (D) $\sqrt{2}$
- If $f(x) = \log_x(\log x)$, then $f'(e)$ is _____.
 (A) 1 (B) e (C) $\frac{1}{e}$ (D) 0
- If $y = 25^{\log_5 \sin x} + 16^{\log_4 \cos x}$, then $\frac{dy}{dx} =$ _____.
 (A) 1 (B) 0
 (C) 9 (D) $\cos x - \sin x$
- If $f'(4) = 5$, $f(4) = 3$, $g'(6) = 7$ and $R(x) = g[3 + f(x)]$, then $R'(4) =$ _____.
 (A) 35 (B) 12 (C) $\frac{7}{5}$ (D) 105
- If $y = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$, $x \in (-1, 1)$, then $\frac{dy}{dx} =$ _____.
 (A) $\frac{-2}{1+x^2}$ (B) 1
 (C) $\frac{2}{1+x^2}$ (D) $\frac{1}{1+x^2}$
- If g is the inverse of f and $f'(x) = \frac{1}{1+x^4}$, then $g'(x) =$ _____.
 (A) $\frac{1}{1+[g(x)]^4}$ (B) $\frac{4x^3}{1+x^4}$
 (C) $\frac{1}{1+[g(x)]^3}$ (D) $1 + [g(x)]^4$
- If $\sin^{-1}(x^3 + y^3) = a$, then $\frac{dy}{dx} =$ _____.
 (A) $\frac{-x}{\cos a}$ (B) $\frac{-x^2}{y^2}$
 (C) $\frac{y^2}{x^2}$ (D) $\frac{\sin a}{y}$
- If $x = \cos^{-1}(t)$, $y = \sqrt{1-t^2}$, then $\frac{dy}{dx} =$ _____.
 (A) t (B) -t (C) $\frac{-1}{t}$ (D) $\frac{1}{t}$

- If $x^2 + y^2 = 1$, then $\frac{d^2x}{dy^2} =$ _____.
 (A) x^3 (B) y^3 (C) $-y^3$ (D) $\frac{-1}{x^3}$
- If $x^2 + y^2 = t + \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $\frac{dy}{dx} =$ _____.
 (A) $\frac{x}{2y}$ (B) $\frac{-y}{x}$ (C) $\frac{-x}{2y}$ (D) $\frac{y}{x}$
- If $x = at^4$, $y = 2at^2$, then $\frac{dy}{dx} =$ _____.
 (A) $\frac{1}{t}$ (B) $\frac{-1}{t}$ (C) $\frac{1}{t^2}$ (D) $\frac{-1}{t^2}$

Answers:

1. (C) 2. (C) 3. (B) 4. (A)
 5. (C) 6. (D) 7. (B) 8. (A)
 9. (D) 10. (B) 11. (C)

Hints:

- $y = \sec(\tan^{-1} x)$
 $= \sec(\sec^{-1} \sqrt{x^2 + 1}) = \sqrt{x^2 + 1}$
 $\Rightarrow \frac{dy}{dx} = \frac{1}{2\sqrt{x^2 + 1}}(2x) = \frac{x}{\sqrt{x^2 + 1}}$
 $\Rightarrow \left(\frac{dy}{dx}\right)_{x=1} = \frac{1}{\sqrt{2}}$
- $f(x) = \log_x(\log x) = \frac{\log(\log x)}{\log x}$
 $\therefore f'(x) = \frac{\log x \cdot \frac{1}{\log x} \cdot \frac{d}{dx}(\log x) - \log(\log x) \cdot \frac{1}{x}}{(\log x)^2}$
 $= \frac{\frac{1}{x} \log(\log x)}{(\log x)^2}$
 $\therefore f'(e) = \frac{\frac{1}{e} \log 1}{(1)^2}$
 $= \frac{1}{e} - 0 = \frac{1}{e}$
- $y = 25^{\log_5 \sin x} + 16^{\log_4 \cos x}$
 $= 5^{2\log_5 \sin x} + 4^{2\log_4 \cos x}$
 $= 5^{\log_5 (\sin x)^2} + 4^{\log_4 (\cos x)^2}$
 $= \sin^2 x + \cos^2 x \quad \dots [\because a^{\log_a f(x)} = f(x)]$
 $= 1$
 $\therefore \frac{dy}{dx} = 0$



4. $R(x) = g[3 + f(x)]$
 $\therefore R'(x) = g'[3 + f(x)] \cdot \frac{d}{dx} [3 + f(x)]$
 $= g'[3 + f(x)] \cdot f'(x)$
 $\therefore R'(4) = g'[3 + f(4)] \cdot f'(4)$
 $= g'(3 + 3) \cdot 5$
 $= 5g'(6)$
 $= 5(7) = 35$
5. Put $x = \tan \theta$, $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$
 $\therefore \theta = \tan^{-1} x$
 $\therefore y = \tan^{-1} \left(\frac{2 \tan \theta}{1 - \tan^2 \theta} \right)$
 $= \tan^{-1}(\tan 2\theta)$
 $= 2\theta = 2 \tan^{-1} x$
 $\therefore \frac{dy}{dx} = \frac{2}{1 + x^2}$
6. $g(x) = f^{-1}(x)$
 $\therefore f[g(x)] = x$
 Differentiating w.r.t. x , we get
 $f'[g(x)] \cdot g'(x) = 1$
 $\therefore g'(x) = \frac{1}{f'[g(x)]} = \frac{1}{1 + [g(x)]^4}$
 $= \frac{1}{1 + [g(x)]^4}$
7. $\sin^{-1}(x^3 + y^3) = a$
 $\therefore x^3 + y^3 = \sin a$
 Differentiating w.r.t. x , we get
 $3x^2 + 3y^2 \frac{dy}{dx} = 0$
 $\therefore \frac{dy}{dx} = \frac{-x^2}{y^2}$
8. $x = \cos^{-1} t$
 $\therefore t = \cos x$
 $y = \sqrt{1 - t^2}$
 $= \sqrt{1 - \cos^2 x} = \sin x$
 $\therefore \frac{dy}{dx} = \cos x = t$
9. $x^2 + y^2 = 1$... (i)
 Differentiating w.r.t. x , we get
 $2x + 2y \frac{dy}{dx} = 0$
 $\therefore \frac{dy}{dx} = \frac{-x}{y}$
 $\therefore \frac{dx}{dy} = \frac{-y}{x}$... (ii)
 $\therefore \frac{d^2 x}{dy^2} = - \left(\frac{x \cdot 1 - y \cdot \frac{dx}{dy}}{x^2} \right)$

$$= - \left[\frac{x - y \left(\frac{-y}{x} \right)}{x^2} \right] \quad \dots [\text{From (ii)}]$$

$$= - \left(\frac{x^2 + y^2}{x^3} \right)$$

$$= \frac{-1}{x^3} \quad \dots [\text{From (i)}]$$

10. $x^2 + y^2 = t + \frac{1}{t}$
 Squaring on both sides, we get
 $x^4 + y^4 + 2x^2 y^2 = t^2 + \frac{1}{t^2} + 2$
 $\therefore \left(t^2 + \frac{1}{t^2} \right) + 2x^2 y^2 = t^2 + \frac{1}{t^2} + 2$
 $\therefore x^2 y^2 = 1$
 Differentiating w.r.t. x , we get
 $x^2 \cdot 2y \frac{dy}{dx} + y^2 \cdot 2x = 0$
 $\therefore x^2 y \frac{dy}{dx} = -xy^2$
 $\therefore \frac{dy}{dx} = \frac{-y}{x}$
11. $x = at^4$ and $y = 2at^2$
 $\therefore \frac{dx}{dt} = 4at^3$ and $\frac{dy}{dt} = 4at$
 $\therefore \frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{4at}{4at^3} = \frac{1}{t^2}$

Very Short Answers (1 Mark)

1. Differentiate $y = \sqrt{x^2 + 5}$ w.r.t. x .

Solution:

$$y = \sqrt{x^2 + 5}$$

$$\therefore \frac{dy}{dx} = \frac{d}{dx} (\sqrt{x^2 + 5})$$

$$= \frac{1}{2\sqrt{x^2 + 5}} \cdot \frac{d}{dx} (x^2 + 5)$$

$$= \frac{1}{2\sqrt{x^2 + 5}} \cdot (2x + 0) = \frac{x}{\sqrt{x^2 + 5}}$$

2. Differentiate $y = e^{\tan x}$ w.r.t. x .

Solution:

$$y = e^{\tan x}$$

$$\therefore \frac{dy}{dx} = \frac{d}{dx} (e^{\tan x})$$

$$= e^{\tan x} \cdot \frac{d}{dx} (\tan x)$$

$$= e^{\tan x} \cdot \sec^2 x$$

Page no. **327** to **409** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**

Note: The ® marked questions are the part of reduced/non-evaluative portion for academic year 2020-21 only.

Multiple Choice Questions (1 Mark)

- The outer layer of pollen grain is thick and made up of complex, non-biodegradable substance called as _____.
(A) lignin (B) cellulose
(C) pectin (D) sporopollenin
- Sporoderm is made up of _____.
(A) exosporium and endosporium
(B) outer integuments and inner integument
(C) testa and tegmen
(D) exine and intine
- The number of meiotic and mitotic divisions necessary for development of female gametophyte in angiosperms is _____.
(A) 1 meiosis and 2 mitosis
(B) 1 mitosis and 3 meiosis
(C) 1 meiosis and 1 mitosis
(D) 1 meiosis and 3 mitosis
- Identify the odd one with respect to pollinating agent.
(A) Baobab (B) Bottle brush
(C) Kadamb (D) Sausage
- In vitro* pollen germination and pollen tube elongation can be induced by _____.
(A) boric acid (B) glucose
(C) lactose (D) sucrose
- Self-incompatibility is found in flowers of plants _____.
(A) *Calotropis* (B) maize
(C) *Thea* (D) *Gloriosa*
- Porogamy refers to entry of pollen tube through _____.
(A) integuments (B) chalaza
(C) micropyle (D) stigma
- _____ is an example of helobial endosperm.
(A) *Adoxa* (B) coconut
(C) *Asphodelus* (D) sunflower
- The single shield shaped cotyledon in monocot seed is known as _____.
(A) coleoptile (B) scutellum
(C) aleurone layer (D) perisperm
- The example of dicot endospermic seed is _____.
(A) castor (B) pea
(C) mango (D) bean

Answers:

1. (D) 2. (D) 3. (D) 4. (B)
5. (D) 6. (C) 7. (C) 8. (C)
9. (B) 10. (A)

[Note: 5. Sucrose is mostly used for pollen germination and pollen tube elongation, however, Boric acid, glucose and lactose can also be used for inducing in vitro pollen germination and pollen tube elongation.]

Single Sentence Answers (1 Mark)

1. Why anther is called as tetrasporangiate structure?

Ans: Due to presence of four pollen sacs in dithecous anther it is called as tetrasporangiate structure.

2. At which stage pollen grains are shed from the anther in Angiosperms?

Ans: At two-celled stage pollen grains are shed from the anther in Angiosperms.

3. What is hilum with respect to ovule?

Ans: Hilum is the point of attachment of funiculus to the main body of ovule.

4. What is protandry?

Ans: Protandry is a condition in which anthers mature first, but the stigma of the same flower is not receptive at that time.

5. Name any one plant in which double fertilization was discovered?

Ans: *Lilium* and *Fritillaria* [Any one plant]

6. Why fertilization process in angiosperms is called as double fertilization?

Ans: In fertilization process of angiosperms, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as double fertilization.

7. Which is the most common type of endosperm in angiospermic families?

Ans: Nuclear type is the most common type of endosperm found in angiospermic families.

8. What is the role of suspensor during the development of embryo?

Ans: The suspensor helps in pushing the embryo in the endosperm.



9. What is adventive polyembryony?

Ans: In adventive polyembryony, embryos may develop from somatic nucellus or integuments along with normal zygotic embryo.

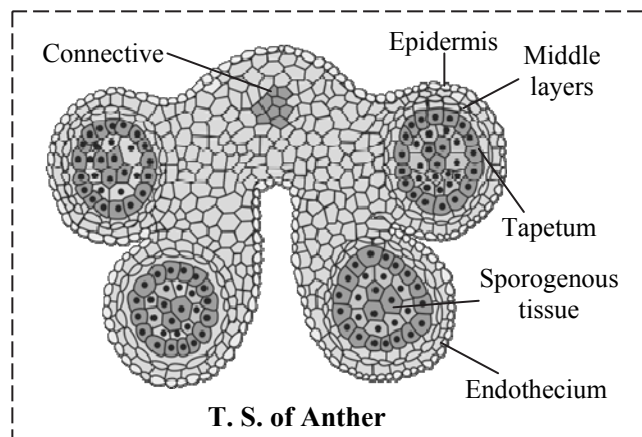
10. Name the hormone produced by unfertilised ovary responsible for enlargement of ovary into fruit.

Ans: Auxin (Indole-3 Acetic Acid)

2 Marks Questions

1. Draw a well labelled diagram of T.S. anther.

Ans:



T. S. of Anther

[Four correct Labels ½ Mark each]

2. Describe the structure of pollen grain.

Ans:

i. The process of formation of microspores from diploid microspore mother cell through meiotic cell division inside the microsporangia or pollen sacs is called microsporogenesis.

ii. **Structure of microspore:** Pollen grain/microspore is a non-motile, haploid, unicellular body with single nucleus. It is surrounded by a two layered wall called **sporoderm**. The outer wall is called **exine** and the inner wall is called **intine**.

iii. **Exine:** The exine is thick and made up of complex, non-biodegradable, substance called **sporopollenin** and it is resistant to chemicals. It may be smooth or with a sculptured pattern (characteristic of the species).

At some places exine is very thin showing thin areas known as **germ-pores**.

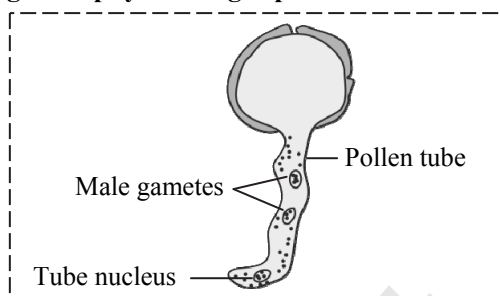
Germ-pores are meant for the growth of emerging pollen tube during germination of pollen grain.

iv. **Intine:** The inner wall layer, intine consists of cellulose and pectin.

[Each point ½ Mark]

3. Draw a well labelled diagram of male gametophyte of angiosperms.

Ans:



[Diagram - 1 Mark, Any two correct labels (male gamete, tube nucleus and pollen tube) ½ Mark each]

4. Describe the structure of female gametophyte of angiosperms.

Ans:

i. In angiosperms, female gametophyte present in ovule is haploid embryo-sac. Each embryo-sac contains egg apparatus, 3 antipodal cells and 2 polar nuclei.

ii. Egg apparatus consists of large central, haploid **egg cell** and two supporting haploid **synergid cells**. Synergid shows hair like projections called **filiform apparatus**, which guide the pollen tube towards the egg.

iii. **Antipodal cells** are group of three cells present at the chalazal end.

iv. The two haploid polar nuclei of large central cell fuse to form **diploid secondary nucleus** or definitive nucleus, just prior to fertilization.

[4 points ½ Mark each]

5. Mention various adaptations for wind pollination.

Ans: Adaptations in anemophilous flowers:

i. The flowers are small, inconspicuous, colourless, without nectar and fragrance (odour).

ii. The pollen grains are light in weight, dry and produced in large numbers to increase chances of pollination considering wastage of pollen grains.

iii. Stigma is feathery to trap pollens carried by wind currents.

iv. Stamens are exserted with long filaments and versatile anthers.

v. Stamens and stigmas are exposed to air currents.

[Any four points ½ Mark each]

6. What are the different adaptations shown by bird pollinated flowers?

Ans: Ornithophilous plants shows following adaptations:

i. Flowers are usually brightly coloured, large and showy.

ii. They secrete profuse, dilute nectar.

iii. Pollen grains are sticky and spiny.

iv. Flowers are generally without fragrance, as birds have poor sense of smell.

[Any four points ½ Mark each]



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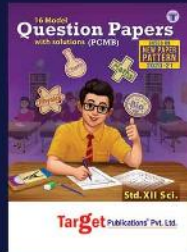
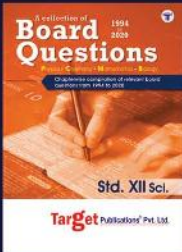
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