Model Question Paper

Std. XI **Sub. Chemistry**

Time : 3 Hrs. **Marks : 70**

General Instruction :

1) All the questions are compulsory.
2) Section A contains Q.No.1 to 4 of multiple choice type of questions carrying one mark each. Q.No.5 to 8 are very short answer type of questions carrying one mark each.
3) Section 'B' contains Q.No. 9 to 15 of short answer type of questions carrying two marks each. Internal choice is provided to only one question.
4) Section 'C' contains Q.No. 16 to 26 of short answer type of questions carrying three marks each. Internal choice is provided to only one question.
5) Section D contains Q.No. 27 to 29 of long answer type of questions carrying five marks each. Internal choice is provided to each questions.
6) Use log-table if necessary. Use of calculator is not allowed.
7) Given data :
   Avogadro's Number, $N_A = 6.022 \times 10^{23}$
   Gas constant, $R = 8.314\ J\ K^{-1}\ mol^{-1}$
   Atomic Mass, C = 12, O = 16, H = 1, N = 14

SECTION A

Q.1 At STP 22 g of carbon dioxide gas occupies a volume of

a) 44 dm^3 b) 22.4 dm^3 c) 11.2 dm^3 d) 5.6 dm^3

Q.2 $CuSO_4$ is a salt of

a) Strong acid and strong base.
b) Strong acid and weak base.
c) Weak acid and strong base.
d) Weak acid and weak base.

Q.3 Which of the following functional groups in case of polyfunctional compound has highest priority for the base name ?

a) –OH b) –COOH c) –CHO d) –CN

Q.4 The number of chain isomers of hexane is

a) 5 b) 4 c) 3 d) 6

Q.5 Which type of interaction is present in polar molecules ?

Q.6 What is the IUPAC name of the following compound ?

$H_2C = CH - C \equiv CH$

Q.7 Why is hydrogen molecule inert at room temperature ?

Q.8 Write mathematical expression of compressibility factor.

SECTION-B

Q.9 Explain the trends in the following factors with respect to ionisation enthalpy.

a) Nuclear charge b) Screening effect.

Q.10 State Octet rule. Explain Incomplete Octet with suitable example.

OR

Ammonia shows SP^3 hybridisation, expected SP^3 bond angle is $109^0 28'$ but bond angle in ammonia is $107^o\ 18'$, explain.

Q.11 State Pauli's Exclusion principle. Write electronic configuration of Mn (Z = 25)

Q.12 Explain Amphoteric nature of water.

Q.13 Distinguish between electrophiles and nucleophiles.

Q.14 How is acetylene prepared from the followings ?

a) Calcium carbide b) Ethylene dibromide

Q.15 What is the action of following on Boron ?

a) Fused with NaOH b) HNO_3

SECTION C

Q.16 What is coagulation ? Explain any two methods of conagulation.

Q.17 Calculate the number of moles, molecules and total number of atoms present in 1.7×10^{-4} kg of ammonia.

Q.18 Explain why gas laws are not obeyed below -273.15^oC.

250 mL round bottom flask containing air was heated from 25^oC to 475^oC. Calculate the fraction of air left behind in the flask.

Q.19 Define degree of dissociation. Derive an expression of Ostwald's dilution law for weak base.

OR

Define buffer solution. Explain mechanism of basic buffer solution.

Q.20 Balance the following redox reaction by using oxidation number method.

$CuO + NH_3 \rightarrow Cu + N_2 + H_2O$

Q.21 What are quantum numbers ? If n = 2, write all possible values of *l* and m.

Q.22 Write the unit in which ozone concentrations in stratosphere are measured. Write the effects of ozone depletion in the stratosphere.

Q.23 How is n-butane prepared from ethyl bromide ?

What is the action of following on ethane ?

a) conc HNO_3 , Δ b) Br_2 , Δ in presence of $AlBr_3$

Q.24 Explain the tetrahedral structure of silicates. How producer gas is prepared ?

Q.25 Write a note on -

a) Inductive effect b) Electromeric effect

Q.26 What is the action of following on benzene ?

a) Nitrating Mixture, Δ b) fuming H_2SO_4 , Δ

c) Methyl chloride in presence of anhy. $AlCl_3$

SECTION-D

Q.27 Explain the formation of ethylene molecule on the basis of hybridisation. Why sigma bond is stronger than Pi bond ?

OR

Explain the formation of O_2 molecule on the basis of molecular orbital theory.

Calculate the bond order in O_2 molecule.

Q.28 Explain diagonal relationship between lithium and Magnesium. Give biological importance of sodium and potassium. Write uses of sodium carbonate.

OR

What is the action of following on magnesium ?

a) O_2 b) N_2

Explain the anamolous behavior of beryllium. Write uses of $CaCO_3$.

Q.29 Define electronegativity. Explain the factors affecting on the magnitude of electronegativity.

Explain Markownikoff 's rule with suitable example.

What is the action of alcoholic KOH on ethyl bromide ?

OR

Fluorine has less negative electron gain enthalpy than chlorine, give reason.

Describe different types of isomerism in alkenes.

Model Question Paper

Std. XI **Sub. Physics**

Time : 3 Hrs. **Marks : 70**

General Instruction :

1) All the questions are compulsory.
2) **Section A** contains Q.No.1 to 4 of multiple choice type of questions carrying one mark each. Q.No.5 to 8 are very short answer type of questions carrying one mark each.
3) **Section 'B'** contains Q.No. 9 to 15 of short answer type of questions carrying two marks each. Internal choice is provided to only one question.
4) **Section 'C'** contains Q.No. 16 to 26 of short answer type of questions carrying three marks each. Internal choice is provided to only one question.
5) **Section D** contains Q.No. 27 to 29 of long answer type of questions carrying five marks each. Internal choice is provided to each question.
6) Use log-table if necessary. Use of calculator is not allowed.

Physical Constants :

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________ etc.

Section A

Q.1 A ball is thrown from a certain point with speed 'V_0' at an angle θ with the vertical. A person runs from the same point and at the same instant with the speed '$\frac{V_0}{2}$' to catch the ball. If he catches the ball, then angle θ will be

a) 75^0 b) 60^0 c) 45^0 d) 30^0

Q.2 A conductor carrying current 'I' having length 'l' is placed in uniform magnetic induction $\vec{B}$. The force experienced by it will be maximum, if the angle between conductor and $\vec{B}$ is

a) 0^0 b) 30^0 c) 60^0 d) 90^0

Q.3 The intensity of sound increases at night. This is due to

a) increase in density of air b) decrease in density of air
c) decrease in temperature d) decrease in noise level

Q.4 What is the order of magnitude of ($10^4 + 10^2$) ?

a) 10^2 b) 10^4 c) 10^6 d) 10^8

Q.5 State the relation between values of coefficients of restitution for perfectly inlastic collision, elastic collision and perfectly elastic collision.

Q.6 If the angle of dip at two places A and B are 30^0 and 45^0 respectively, then find the ratio of horizontal components of earth's magnetic field at places A and B.

Q.7 When a liquid contained in a bucket is stirred and placed for some time, it comes to rest. Why?

Q.8 A bomb at rest explodes into 3 parts of same mass. The momenta of two parts are $-2P\hat{i}$ and $P\hat{j}$ respectively. What is the magnitude of momentum of the third part ?

Section B

Q.9 State the new cartesian sign conventions used in ray optics.

Q.10 An electric dipole consists of two opposite charges each of magnitude 15 μC separated by a distance 2.0 cm and kept in uniform electric field. The maximum torque acting on the dipole is 3.5×10^{-3} Nm. What is the intensity of uniform electric field ?

Q.11 Railway lines are to be laid with gaps between the rails to allow for expansion. How much gap should be kept between two adjacent rails if the highest temperature in summer is 50^0C and lowest temperature in winter is 10^0C ?
[Given : Length of each rail = 10m, $\alpha_{iron} = 12 \times 10^{-6} / {}^0C$]

Q.12 Define ; (a) Temperature coefficient of resistance (b) EMF of a cell

OR

Q.12 Evaluate resistance for the colour coded resistor - violet, green, yellow, golden .

Q.13 State any two laws of kinetic friction.

Q.14 State any four characteristics of gravitational force.

Q.15 What is ozone layer ? What an important purpose does it serve ?

Section C

Q.16 Show that vector product of two vectors $\vec{P}$ and $\vec{Q}$ $= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ P_x & P_y & P_z \\ Q_x & Q_y & Q_z \end{vmatrix}$

Q.17 Explain application of Ohm's law to a complete circuit.

Q.18 Show that the velocity of sound in air is directly proportional to square root of its absolue temperature.

Q.19 State and prove work-energy theorem.

Q.20 State the dimensions of coefficient of viscosity. Show that $1 \dfrac{Ns}{m^2} = 10$ poise

Q.21 Determine the focal length of a convex lens in air of radii of curvatures 24 cm and 32 cm. What will be the focal length of the same lens if it is immersed in water ? [$\mu_g = 3/2$, $\mu_w = \dfrac{4}{3}$]

Q.22 Derive an expression for electric potential at a point due to a point charge.

OR

Q.22 Obtain the relation betweeen electric field intensity and electric potential. Hence define potential gradient.

Q.23 The period of oscillation of a simple pendulum is measured. In successive measurements, the readings turn out to be 2.63 s, 2.56 s, 2.40 s, 2.71 s and 2.80 s. Calculate mean absolute error and relative error.

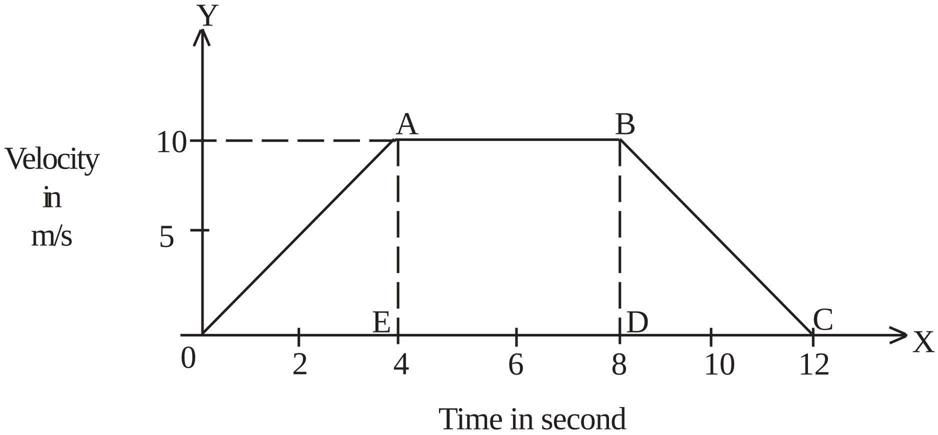
Q.24 Derive an expression for the torque acting on a magnet placed in a uniform magnetic induction. Hence define magnetic dipole moment of a bar magnet.

Q.25 If $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - \hat{k}$ then find (i) $|\vec{A}|$ (ii) $\vec{A} \cdot \vec{B}$

Q.26 State any two factors on which the quantity of heat (Q) conducted in the steady state through solids. State the formula for 'Q'. Hence define coefficient of thermal conductivity.

Section D

Q.27 Following figure shows variation of velocity of the car with time. By observing figure, answer following questions.



i) What is the maximum speed attained by the car ?

ii) Which part of the graph shows zero acceleration ?

iii) Find the distance travelled by the car in first 8 second.

State any four characteristics of displacement.

OR

Q.27 A cricket ball is thrown at a speed of 28 m/s in a direction 30^0 above the horizontal. Calculate i) the maximum height ii) time of flight iii) horizontal ranger.

State any two assumptions while studying projectile motion of a projectile.

Q.28 Obtain an expression for the magnetic induction at the centre of a circular coil carrying a current. State Fleming's left hand rule and mention any two equivalent SI units of magnetic induction.

OR

Q.28 Derive an expression for the torque acting on a rectangular current loop in a uniform magnetic field.

State Biot - Savart's law and write it in vector form.

Q.29 By using prism formula, obtain an expression fo refractivity of a thin prism.

State Snell's law of refraction. Define critical angle.

OR

Q.29 Obtain an expression for dispersive power in terms of refractive index. How will look the sky, beyond the atmosphere ?

State Rayleigh's law of scattering and principle of reversibility of light.

Model Question Paper

Std. XI **Sub. Mathematics and Statistics**

Time : 3 Hrs. **Marks : 80**

Note: I) All qustion are compulsary

II) The question paper consist of 30 questions divided into four sections A, B, C, D

III) Section A contains 6 MCQ questions of 1 mark each

Section B contains 8 questions of 2 mark each

Section C contains 6 questions of 3 mark each

Section D contains 10 questions of 4 mark each

IV) Use of logarithmic tables is allowed.

V) Use Calculator is not allowed.

Section A (6 marks)

Select and write the most appropriate answer from the given alternative for each sub questions. **06**

Q.1 Which of the following expression equals $\cos 2\theta$ for all $\theta \in R$?

a) $1 + 2\sin^2\theta$ b) $\cos^2\theta + \sin^2\theta$ c) $1 - 2\sin^2\theta$ d) $2\cos^2\theta + 1$

Q.2 The distance between the parallel lines $3x + 2y + 6 = 0$ and $9x + 6y - 7$ is .....

a) $\frac{25}{\sqrt{3}}$ b) $\frac{25}{3\sqrt{13}}$ c) $\frac{25}{13\sqrt{3}}$ d) $\frac{5}{3\sqrt{13}}$

Q.3 If the vectors $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} + \lambda\hat{j} - 3\hat{k}$ are perpendicular to each other, then value of λ is -----

a) -3 b) 3 c) 9 d) -9

Q.4 If set A has n elements then the total number of subsets of A is ....

a) n b) $2n$ c) 2^n d) n^2

Q.5 If $y = x\cos x$ then $\frac{dy}{dx}$ = ...

a) $-x\sin x + \cos x$ b) $x\sin x + \cos x$

c) $-x\cos x + \sin x$ d) $x\cos x + \sin x$

Q.6 $\int (\cos 6x + \cos 2x)\, dx$ = ...

a) $\frac{\sin 6x}{6} + \frac{\sin 2x}{2} + C$ b) $-\left[\frac{\sin 6x}{6} + \frac{\sin 2x}{2}\right] + C$

c) $\frac{\cos 6x}{6} + \frac{\cos 2x}{2} + C$ c) $\frac{\sin 6x}{6} - \frac{\cos 2x}{2} + C$

Section 'B' (Marks 16)

Q.7 Find the length of an arc of circle which subtends an angle of 108^0 at the center, if the radius of the circle is 15 cm.

Q.8 Express $\sin 5x - \sin 4x$ as a product of trigonometrc function

OR

Prove that $\sin(45^0 + A) . \sin(45^0 - A) = \frac{1}{2}\cos(2A)$

Q.9 Find points of Y axis which lies on the locus reprsented by equation
$3x^2 - 5xy + 6y^2 - 54 = 0$

Q.10 If A (2, –3) and B (–3, 5) are end points of a diameter of a cricle then find the equation of the circle.

Q.11 Find the range of the function $f(x) = x^2 - 6x + 11$, fore the $x \in R$

Q.12 Solve the equation $\log(x + 3) + \log(x - 3) = \log 16$

Q.13 If u and v are differentialble functions of x and y = u + v then that

$$\frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$$

Q.14 Evaluate $\int \frac{\sin x}{1 - \sin x} dx$

Section 'B' (Marks 18)

Q.15 If $\tan\theta = -\frac{4}{3}$, $3\frac{\pi}{2} < \theta < 2\pi$ then find the value of $3\sec\theta + 5\tan\theta$

OR

Prove that $\frac{\sin\theta}{1 + \cos\theta} + \frac{1 + \cos\theta}{\sin\theta} = 2\operatorname{cosec}\theta$

Q.16 Derive the standard equation of the parabola with proper choice of coordinate axes.

Q.17 Find the feasible solution of the inequations $2x + 3y < 6$, $x + y > 2$, $x > 0$, $y > 0$

Q.18 If $f : R \to R$ is given by $f(x) = x^2 + 3x + 2$ then find $x \in R$ such that $x \neq -1$ and $f(x) = f(-1)$

Q.19 Prove that $\lim\limits_{x \to 0} \frac{x^n - a^n}{x - a} = na^{n-1}$, $n \in N$ and $a > 0$

OR

Evaluate $\lim\limits_{x \to 0} \frac{\sin(a + x) + \sin(a - x) - 2\sin a}{x \sin x}$

Q.20 find the standard deviation (S.D.) of the following frequency distribution.

x_i	1	2	3	4	5
f_i	a	2a	3a	4a	5a

Section 'D' (Marks 40)

Q.21 Prove that $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}} = 2\cos\theta$

Q.22 If p is the length of perpendicular from the origin to the line $ax + by + c = 0$ then prove that

$$P = \left| \frac{c}{\sqrt{a^2+b^2}} \right|$$

OR

Find the equation of the line passing through the point of interection of the lines $x - 5y - 17 = 0$ and $8x + 3y - 7 = 0$ and which makes equal intercepts on the coordinate axes.

Q.23 If A (1, 1, 1), B (–2, 4, 3), C (–1, 5, 5) and D (2, 2, 6) are four points then find the vectors of magnitude 4 units perpendicular to $\overline{AB}$ and $\overline{CD}$.

OR

Find the total work done by the resultant of the forces $\overline{F_1} = 3\hat{i} + 4\hat{j} - 5\hat{k}$, $\overline{F_2} = \hat{i} + \hat{j} + \hat{k}$ and $\overline{F_3} = 2\hat{i} - 4\hat{j} + 7\hat{k}$ in displacing particle from the point A (1, 2, 4) to point B (3, 4, 7)

Q.24 Solve the following system of equations by Cramer's rule.

$2x - y + 3z = 9, \quad x + y + z = 6, \quad x - y + z = 2$

Q.25 If $A = \begin{bmatrix} -3 & 2 \\ 2 & -4 \end{bmatrix}$ $B = \begin{bmatrix} 1 & x \\ y & 0 \end{bmatrix}$ and $(A + B)(A - B) = A^2 - B^2$ then find the values of x and y.

Q.26 Find the square roots of the complex number $2 + 2\sqrt{3}\,i$

Q.27 Find the four numbers in A. P. such that the sum of the first and last numbers in 8 and product of second and third numbers is 12.

Q.28 If ${}^{(x+y)}P_2 = 56$ and ${}^{(x-y)}P_2 = 12$ the find the values of x and y.

Q.29 Prove that $1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \dfrac{n(n+1)(2n+1)}{6}$, for $n \in N$, by using method of induction.

OR

Using Binomial theorem, evaluate $(0.98)^{-3}$ upto four decimal places.

Q.30 A card is drawn from a well shuffled pack of 52 playing cards. Consider the two event A and B given by A : a club card is drawn , B : an ace card is drawn

Show that event A and B are independent.

Model Question Paper

SUBJECT: BIOLOGY

Standard XI

Time : 3hrs. **Max. Marks : 70**

General Instructions:

1. All questions are compulsory.
2. **Section A** contains Q. no. 1 to 4 of **Multiple Choice** type of Questions carrying one mark each. Q. No. 5 to 8 of Very Short Answer **(VSA)** type of questions carrying one mark each.
3. **Section B** contains Q. no.9 to 18 of Short Answer **(SA)** type Questions carrying two marks each. Internal choice is provided to only one question.
4. **SectionC** contains Q. no.19 to 27 of Short Answer **(SA)** type Questions carrying three marks each. Internal choice is provided to only one question.
5. **Section D** contains Q. no.28 to 30 of Long Answer **(LA)** type Questions carrying five marks each. Internal choice is provided to each question.

Section A

Write the most appropriate answer from the given options.

1. Simple lipids are esters of ———————— (1)
   a. amino acids
   b. proteins
   c. phosphorus
   d. fatty acids with glycerols
2. —— are small, circular ssRNAs without a protein coat. (1)
   a. Viroids
   b. Viruses
   c. Animal viruses
   d. Plant viruses
3. The ventral nerve cord of cockroach,in thoracic and abdominal region, bears ________ pairs of ganglia. (1)
   a. 10
   b. 8
   c. 6
   d. 9

4. Which one the following is not a synovial joint? (1)

   a. Hinge

   b. Intervertebral

   c. Condyloid

   d. Pivot

Answer the following questions in one sentence each:

5. 'Mangifera Indica' Write the given scientific name correctly using Binomial system of nomenclature, the author is Linnaeus. (1)

6. Why the person suffering from Marasmus has dry, thin and wrinkled skin. (1)

7. Give role of synovial fluid. (1)

8. What are ommatidia? (1)

Section B

Answer the following questions in short:

9. Give an account of non-genetic RNA. (2)

10. What is cytokinesis? How it differs in plant and animal cells. (2)

11. Describe the role of

    a. Disulphide bonds

    b. Phospho-di-ester bonds (2)

12. Describe the role of hydathode.

13. Write symbols for the following: bisexual flower, corolla, androecium, inferior ovary. (2)

14. Justify : A body will get affected if liver stops functioning. (2)

15. Sketch and label areolar connective tissue. (2)

16. How mitochondria help in aerobic respiration? (2)

17. Which pH will favor action of pepsin and trypsin? (2)

18. Justify, "all vertebrates are chordates but all chordates are not vertebrates" (2)

OR

Why can't the reptiles fly? (2)

Section C

Answer the following questions:

19. Sketch cell cycle and briefly explain the G1, S and G2 phases. (3)

20. Explain symplast pathway of movement of water from the soil to root xylem. (3)

21. Write functions of the following modifications: (3)

    a. Cladode

b. Leaf hooks

c. Corm

d. Thorn

e. Sucker

f. Bulbil

22. Write salient features of division Bryophyta with respect to its alternation of generation. (3)

23. Prawns and Spiders belong to the same phylum. Give the characteristic feature of phylum to which they belong. (3)

24. Tissue in salivary glands and epidermis of skin both are epithelial type. But still they are different from each other. Make a note of these differences. (3)

25. "Cockroach exhibits sexual dimorphism". Explain the statement. (3)

26. Identify the types of joints in the following examples. (3)

a. Glenoid cavity and humerus

b. Pubic bones

c. Atlas and axis

OR

26. Triceps and biceps in the upper arm are necessary for the movement of lower arm. Explain how do they work?

27. Give one function each of vacuole, plasmid, and lysosome. (3)

Section D

Answer the following questions

28. Give an account of the different types of vascular bundles. (5)

OR

Describe different types of Placentation. (5)

29. What is germination? Explain the type of seed germination shown by the mangroves. Give its suitable example. (5)

OR

Draw growth curve. Explain the three phases of growth. (5)

30. Define the terms – A. Vital capacity

B- Tidal volume

C-Total lung capacity

D – Respiratory reserve volume

E – Effective reserve volume (5)

OR

When you are climbing a hill, you begin to breathe quicker. How is it regulated? (5)

Model Answer with Marking Scheme

Std. XI **Sub. Chemistry**

Time : 3 Hrs. **Marks : 70**

Section A

A.1 (c) 11.2 dm^3 1

A.2 (b) Strong acid and weak base. 1

A.3 (b) –COOH 1

A.4 (a) 5 1

A.5 There is dipole - dipole interaction between polar molecules. 1

A.6 But-1-en-3-yne 1

A.7 Hydrogen molecule is inert due to high H-H bond enthalpy. 1

A.8 $z = \frac{PV}{nRT}$ 1

Section B

A.9 Factors affecting on magnitude of ionisation enthalpy are -

1) Nuclear charge : As nuclear charge increases ionisation enthalpy increases 1

2) Screening effect : As screening effect of inner electrons increases ionisation enthalpy decreases. 1

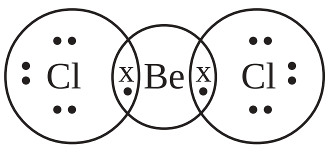
A.10 Octet Rule :

During the formation of molecule, an atom of a particular element gains, looses or shares electron until it acquires a stable electronic configuration of eight electrons in it's valence shell.

Incomplete Octet : 1

When molecules with central atom containing less than eight electrons in it's valence shell are said to have incomplete Octet.

e.g. : Formation of $BeCl_2$. Be has electronic configuration $1s^2$, $2s^2$ while chlorine ($_{17}Cl$) has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$. Two chlorine atoms share one electron each with beryllium atom to form a molecule of $BeCl_2$ as shown in Fig. ½

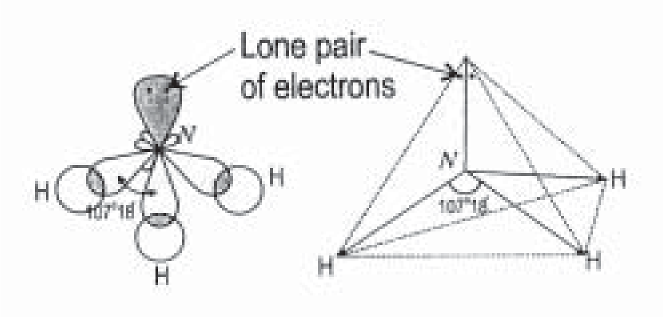


The outermost shell of central Beryllium atom contains only 4 electrons i.e. incomplete Octet. ½

(or any other suitable example)

OR

Out of three SP^3 hybrid orbitals, one contains a lone pair of electrons & other three are half filled. Thus there are three bonding pairs of electrons and one lone pair of electrons. The lone pair - bond pair repulsion is greater than bond pair - bond pair repulsion, hence bonding pair of electrons are pushed closer together and hence H-N-H bond angle is reduced from l09°28′ to 107°18′. 1



Ammonia molecule 1

A.11 Pauli's Exclusion Principle : Statement - "Two electrons in an atom can not have the same set of all four quantum numbers." 1

Mn (Z = 25) $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^5$ $4s^2$

OR [Ar] $3d^5$ $4s^2$ 1

A.12 Amphoteric nature of water : Water acts as an acid. as well as base hence called amphoteric in nature.

a) Water acts as an acid with a base stronger than it self like ammonia. 1

$$H_2O + \ddot{N}H_3 \rightleftharpoons NH_4^+ + OH^-$$

b) Water acts as an base with an acid stronger than itself like hydrogen chloride. 1

$$H_2O + HCl \rightleftharpoons H_3O^+ + Cl^-$$

A.13

Electrophiles	Nucleophiles	
1) These are electron deficient species	1) These are electron rich species.	½
2) These are cations or molecules having electron deficient atoms	2) These are anions or molecules containing atoms with at least one lone pair of electrons	½
3) They attack electron rich centre	3) They attack electron deficient centre	½
4) These are Lewis acids	4) These are Lewis bases	½
5) e.g. H^+, NO_2^+, BF_3, $AlCl_3$	5) eg. OH^-, Cl^-, CN^-, $\ddot{N}H_3$, $H_2\ddot{O}$:, R-$\ddot{\underset{..}{O}}$-H	

A.14) Preparation of acetylene.

a) From calcium carbide

$$\underset{\text{Calcium carbide}}{CaC_2} + 2\,H_2O \rightarrow \underset{\text{Acetylene}}{H-C\equiv C-H} + Ca\,(OH)_2 \qquad 1$$

b) From Ethylene dibromide.

$$\begin{array}{ccccccc} & & Br & & H & & \\ & & | & & | & & \\ H & - & C & - & C & - & H \\ & & | & & | & & \\ & & H & & Br & & \end{array} + \text{alc. } KOH \xrightarrow{\Delta} \underset{\text{Vinyl bromide}}{CH_2=CH-Br} + KBr + H_2O \qquad ½$$

$$CH_2=CH-Br + NaNH_2 \xrightarrow{\Delta} \underset{\text{Acetylene}}{H-C\equiv C-H} + NaBr + NH_3 \qquad ½$$

A.15) a) $2\,B + 6\,NaOH \xrightarrow{\text{Fuse}} \underset{\text{Sodium orthoborate}}{2Na_3BO_3} + 3H_2\uparrow$ 1

b) $B + 3HNO_3 \longrightarrow \underset{\text{Boric Acid}}{H_3BO_3} + 3NO_2\uparrow$ 1

Section C

A.16) The precipitation of colloids by removal of charge associated with colloidal particals is called coagulation. 1

1) The ions of opposite sign to those present on the surface of particles cause the precipitation of the particles. For example positively charged ion of an electrolyte will cause precipitation of negatively charged particles and the negatively charged ions will effect the precipitation of positively charged particles. 1

2) Coagulation can be effected by boiling or freezing the sol. In boiling the electrolyte adsorbed by the sol particles is reduced and the particles are coagulated. In freezing process the dispersion medium is removed and since no medium remains, the particles are coagulated. 1

A.17) i) Number of moles (n) $= \dfrac{1.7 \times 10^{-4}}{17 \times 10^{-3}} = 1.0 \times 10^{-2}$ mol. 1

ii) Number of molecules $= 1 \times 10^{-2} \times 6.022 \times 10^{23}$ 1

$= 6.022 \times 10^{21}$ molecules

iii) Number of atoms $= 4 \times 6.022 \times 10^{21}$

$= 2.4088 \times 10^{22}$ atoms 1

A.18) At that temperature volume of given mass of gas becomes absolutely zero as it is either liquified or solidified. 1

Charle's law : $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$$V_2 = \frac{T_2 V_1}{T_1}$$ ½

$$V_2 = \frac{748.15 \times 250}{298.15}$$ ½

$$V_2 = 627.32 \times 10^{-3} \ dm^{-3}$$ 1

A.19) The degree of dissociation of an electrotype is defined as the fraction of total number of moles of electrolyte that dissociate into its ions when an equilibrium is reached. 1

For Weak base :

Consider 1 mole of weak base BOH dissolved in V dm^3 of solution.

$$BOH_{(aq)} \rightleftharpoons B^{+}_{(aq)} + OH^{-}_{(aq)}$$ ½

	BOH	B^+	OH^-
Intial conc.	1	0	0
at equilibrium	$(1 - \alpha)$	α	α
Concentration at equilibrium ($moldm^{-3}$)	$\frac{1-\alpha}{V}$	$\frac{\alpha}{V}$	$\frac{\alpha}{V}$

½

The base dissociation constant is given by

$$Kb = \frac{[B^+][OH^-]}{[BOH]}$$

$$Kb = \frac{(\alpha/V)(\alpha/V)}{(1-\alpha)/V} = \frac{\alpha^2}{(1-\alpha)V} = \frac{\alpha^2 C}{(1-\alpha)}$$ ½

If C is concentration of base then C=1/V. As BOH is a weak base $(1 - \alpha) \cong 1$

Hence $\alpha = \sqrt{K_b.V} = \sqrt{K_b / C}$ ½

OR

The solution which resists drastic changes in pH upon the addition of small amount of either an acid or a base 1

Mechanism of basic buffer solution :

Example : Mixture of $NH_4OH + NH_4Cl$ is basic buffer

The base and salt ionize as

$NH_4OH_{(aq)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-_{(aq)}$ (partial)

$NH_4Cl \longrightarrow NH_4^+{}_{(aq)} + Cl^-_{(aq)}$ (complete)

a) If a small amount of acid is added

$NH_4OH_{(aq)} + H^+_{(aq)} \longrightarrow NH_4^+{}_{(aq)} + H_2O_{(l)}$ ½

Added H^+ ion are neutralized by NH_4OH and there is no appreciable change in pH ½

b) If a small amount of base is added

$NH_4^+{}_{(aq)} + OH^- \longrightarrow NH_4OH_{(aq)}$ ½

Added OH^- ion are consumed by NH^+_4 ion to form unionized NH_4OH molecules. Thus there is no appreciable increase in pH. ½

A.20) Solution step I Write skeletal equation with oxidation number of each element below their symbol.

$$\underset{+2}{\underset{\uparrow}{Cu}}\ \underset{-2}{\underset{\uparrow}{O}} + \underset{-3}{\underset{\uparrow}{N}}\ \underset{+3}{\underset{\uparrow}{H_3}} \longrightarrow \underset{0}{\underset{\uparrow}{Cu}} + \underset{0}{\underset{\uparrow}{N_2}} + H_2O$$ ½

Step II Write oxidation number of only those elements which undergo change in oxidation number

$$\underset{+2}{CuO} + \underset{-3}{NH_3} \longrightarrow \underset{o}{Cu} + \underset{o}{N_2} + H_2O$$ ½

Loss of e^-

Gain of e^-

Step - III Increase in oxidation number by 3 unit. ½

$2\ NH_3\ (-3) \longrightarrow N_2(o)$

Decrease in oxidation number by 2 unit ½

$Cu\ (2) \longrightarrow Cu\ (o)$

$3\ CuO + 2\ NH_3 \longrightarrow 3\ Cu + N_2 + H_2O$ ½

Step IV Add 2 H_2O molecule towards product side

$3\ CuO + 2\ NH_3 \longrightarrow 3\ Cu + N_2 + 3\ H_2O$ ½

A.21) Quantum number : - The numbers which identify the state of an electron, specify energy and it's location around the nucleus are called quantum numbers. 1

When n = 2 , the possible values of ' l ' & ' m ' are

$l = 0$ m = 0 1

$l = 1$ m = –1 1

m = 0

m = +1

A.22) Units of ozone concentrations in the stratosphere :-

Ozone concentrations in the stratosphere are measured in Dobson units, each unit corresponding to 2.69 x 10^{16} ozone molecules per cm^2. 1

Effects of ozone depletion in the stratosphere (four effects)

The adverse effects of ozone depletion are -

Eye :- Cataract can be developed resulting in blurred vision and without treatment, blindness. ½

Skin :- Exposure can lead to accelerate ageing, wrinkling and various forms of skin cancer.½

Immune system :- A reduced immune response may make the body more susceptible to infectious diseases. ½

Crops :- Interference with photosynthesis could result in lower crop yields. ½

Marine life :- Radiation affects the growth of phytoplankton, the mainstay of ocean food chain.

A.23) Two molecules of ethyl bromide reacts with active metal like sodium in presence of dry ether to give n-butane.

$$C_2H_5Br + 2Na + Br\ C_2H_5 \xrightarrow{\text{dry ether}} \underset{\text{n - butane}}{C_2H_5 - C_2H_5} + 2\ NaBr$$ 1

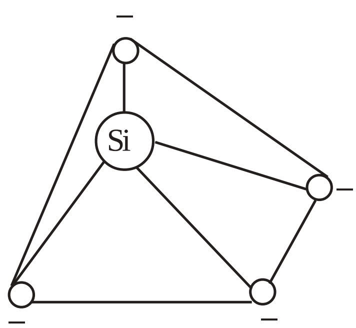
a) By heating a mixture of ethane and concentrated nitric acid at about 423 to 698 K, nitroethane is obtained.

$$CH_3 - CH_3 + HO - NO_3 \xrightarrow{\text{423 to 698 K}} \underset{\text{nitroethane}}{CH_3 - CH_2 - NO_2} + H_2O$$ 1

b) Ethane is treated with bromine in presence of catalyst $AlBr_3$, ethyl bromide is obtained.

$$C_2H_6 + Br_2 \xrightarrow[\triangle]{AlBr_3} C_2H_5 - Br + HBr$$ 1

A.24) Silicates are made up of SiO_4^{4-} tetrahedral unit in which silicon is sp^3 hybridised and is surrounded by four oxygen atoms. The SiO_4^{4-} tetrahedra can be linked together in several different ways. 1



1

Producer gas is prepared by passage of air over hot coke. The mixture of CO and N_2 is produced.

$$2\ C_{(S)} + O_{2(g)} + 4\ N_{2(g)} \xrightarrow{1273\ K} 2CO_{(g)} + 4\ N_{2(g)} \qquad 1$$

A.25) Inductive effect - Permanent polarisation of sigma bond due to difference in electronegativity of bonded atoms is known as inductive effect. 1

$$\overset{+\delta_1}{CH_3} \longrightarrow \overset{+\delta}{CH_2} \longrightarrow \overset{-\delta}{Cl} \qquad ½$$

Electrometric effect - A temporary effect involving complete transfer of shared pair of pi electrons to one of the atoms joined by a multiple bonds when exposed to attacking reagent. 1

$$>C = C< \longrightarrow >\overset{\oplus}{C} - \overset{\ominus}{C}< \qquad ½$$

A.26) Benzene reacts with conc. HNO_3 & conc. H_2SO_4 to give nitrobenzene.

a) C_6H_6 + conc. $HNO_3 \xrightarrow[\Delta]{\text{conc. } H_2SO_4} \underset{\text{nitrobenzene}}{C_6H_5NO_2} + H_2O$ 1

b) Benzene reacts with fuming H_2SO_4 gives benzene sulphonic acid

$C_6H_6 + H_2SO_4 \xrightarrow[373^0K]{\text{Fuming } H_2SO_4} \underset{\text{benzene sulphonic acid}}{C_6H_5SO_3H} + H_2O$ 1

c) Benzene reacts with methyl chloride in pesence of anhydrous $AlCl_3$ to give Toluene.

$C_6H_6 + CH_3Cl \xrightarrow[AlCl_3]{\text{anhydrous}} C_6H_5CH_3 + HCl$ 1

Section D

A.27) Formation of ethylene molecule

It takes place in following steps.

1) Ground state : The central atom is carbon, its atomic no is 6 and its electronic configuration is

C_6 : $1S^2$ $2S^2$ $2P_x^{\ 1}$ $2p_y^{\ 1}$ $2P_z^{\ 0}$

$\boxed{\uparrow\downarrow}\ \boxed{\uparrow\downarrow}\ \boxed{\uparrow \mid \uparrow \mid \ \ }$

2) Excited state : one electron from 2S orbital is pramoted to the 2Pz orbital

C_6 : $1S^2$ $2S^1$ $2P_x^{\ 1}$ $2p_y^{\ 1}$ $2P_z^{\ 1}$ ½

$\boxed{\uparrow\downarrow}\ \boxed{\uparrow}\ \boxed{\uparrow \mid \uparrow \mid \uparrow}$

3) Hybridised state : 2S, $2p_x$ and $2P_y$ orbitals undergo mixing and recasting to form three sp^2 hybrid orbitals of equal energy $2P_z$ remains unhybridised. ½

4) Formation of ethylene molecule

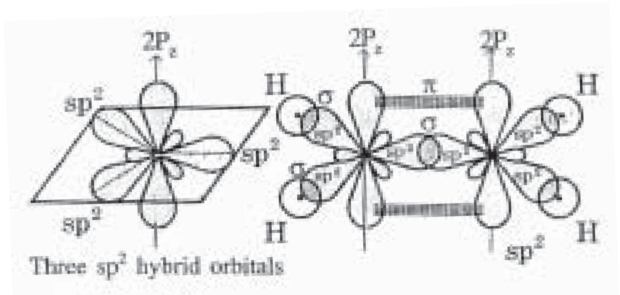
   1) $SP^2C - SP^2C \rightarrow$ one σ bond 1

   2) Two sp^2 of each catom overlaps axialy with 1s orbital of two H - atoms to form four $C - H \rightarrow \sigma$ bonds.

   3) $2p_zC - 2p_zC \rightarrow$ by lateral overlap forms π bond.

   4) H – C – C or C – C – H bond angle is 120^0 & geometry is trigonal planar. 1

   Orbital diagram



Geometry of ethylene molecule

1

sigma bond is stronger than π - bond because

1) Extent of overlapping region in σ bond is more due to co-axial overlapping. 1

2) Where as in pi bond extent of overlapping is less due to lateral overlap.

OR

Formation of O_2 molecule on basis of MOT.

Ele. config. of O $1S^2\ 2S^2\ 2p^4$

Hence in O_2 molecule 16 electrons. 1

Here 1 s orbital is non-bonding.

four electrons in σ_{1s} and σ^*_{1s} , can be ignored 1

four electrons occupy σ_{2s} & σ^*_{2s}, do not contribute

eight electrons occupy $\sigma\ 2P_Z$, $\pi 2P_x$, $\pi 2P_y$ $\pi^* 2p_x$ $\pi^* 2p_y$ ½

on basis of Aufbau principal

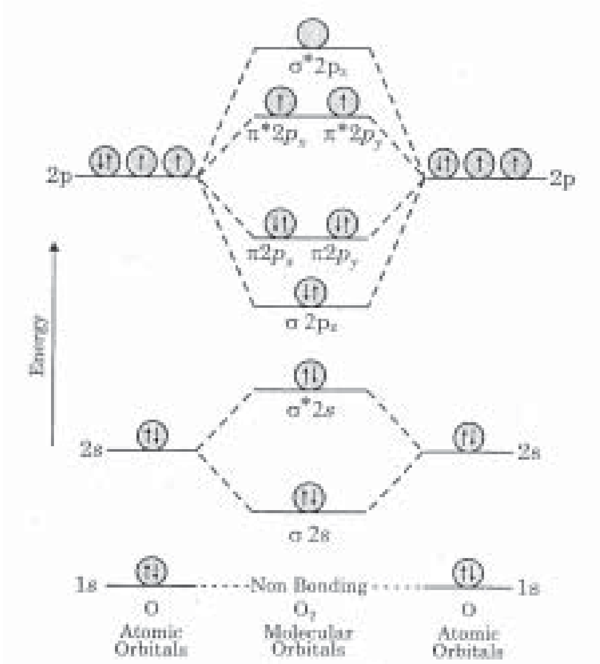
$\pi 2p_x$ $\pi 2p_y$ have one electron each.

O_2 : KK $\sigma 2s^2$ $\sigma^* 2s^2$ $\sigma\ 2p^2_Z$ $\pi\ 2p^2_x$ $\pi\ 2p^2_y$ $\pi^* 2p^1_x$ $\pi^* 2p^1_y$ ½

Bond order $= \dfrac{Nb - Na}{2}$

$= \dfrac{8 - 4}{2}$

$= 2$ 1



1

M.O. diagram for O_2 molecule

Q.28 Digonal Relationship between Li & Mg (4 points)

i) Both Li & Mg are harder than other elements.

ii) Both LiCl and $MgCl_2$ dissolve in ethanol. ½×4

iii) Both combines with oxygen to form monoxides. = 2

iv) Both LiOH and $Mg(OH)_2$ are weak bases.

v) Both combines with nitrogen to form Li_3N, Mg_3N_2

Biological Importance of Na

i) Common salt is most important in diet. ½

ii) Sodium is a major cation in blood plasma. ½

Biological Importance of K

i) Potassium is required for smooth working of muscles. ½

ii) Potassium is a major cation in cytoplasm. ½

Uses of Na_2CO_3

i) It is used in the manufacture of glass, soap, borax and caustic soda. ½

ii) It is used in water softening in Laundry and cleaning. ½

OR

A.28 a) $2Mg + O_2 \longrightarrow 2\ MgO$ 1

b) $3Mg + N_2 \longrightarrow Mg_3\ N_2$ 1

Anamolous behaviour of beryllium

i) 'Be' is hard metal while other alkaline earth metals are soft.

ii) 'Be' is least metallic of all the alkaline earth metals. ½×4

iii) 'Be' has highest m.p., b.p and ionisation enthalpy than all alkaline earth metals. = 2

iv) 'BeO' and 'Be $(OH)_2$' are amphoteric in nature while oxides and hydroxides of other alkaline earth metals are basic.

Uses of $CaCO_3$ (two uses)

i) It is used in the manufacture of quick lime.

ii) It is used as a building material in the form of marble. 1

Q.29 Electronegativity : "The ability of an atom in a chemical compound to attract shared pair of electron to itself is called electronegativity. 1

Two Factors :

1) Atomic size - As atomic size increases electronegativity decreases.

2) Nuclear charge - As nuclear charge increases electronegativity increases.

3) Screening effect : As screening effect increases electronegativity decreases. 2x½=1

Markownikoff's Rule :

"When an unsymmetrical reagent is added to an unsymmetrical alkene, the negative part of the reagent gets attached to that carbon atom which carries less number of hydrogen atoms." 1

Ex. When HBr is added to 1-Propene 2-Bromopropane is obtained as a major product.

$$CH_3 - CH = CH_2 + \overset{\oplus}{H}-\overset{\ominus}{Br}. \longrightarrow CH_3 - \underset{}{\overset{\overset{\displaystyle Br}{|}}{CH}} - CH_3$$ 1

2 – Bromopropane

Action of alc. KOH on ethyl bromide :-

$$C_2H_5Br + \text{alcoholic KOH} \xrightarrow{\Delta} \underset{\text{Ethene}}{CH_2 = CH_2} + KBr + H_2O \qquad 1$$

OR

i) Adding an electron to the 2p orbital (F) leads to greater repulsion than adding an electron to the larger 3p orbital (Cl) 1

ii) Absence of d-orbital and small atomic size of Fluorine 1

Isomerism in Alkenes :

1) Structural Isomerism -

a) Chain isomerism : Difference in carbon chain length.

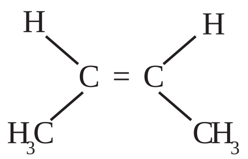
e.g. $\underset{\alpha - \text{Butylene}}{CH_2 = CH - CH_2 - CH_3}$ $\qquad$ $\underset{\text{Isobutylene}}{CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2}$ 1

b) Position Isomerism - Difference in position of double bond in same carbon chain.

e.g. $\underset{\alpha - \text{Butylene}}{CH_2 = CH - CH_2 - CH_3}$ $\qquad$ $\underset{\beta - \text{Butylene}}{CH_3 - CH = CH - CH_3}$ 1

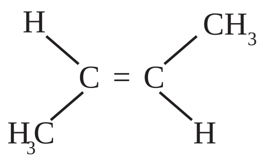
2) Geometrical isomerism -

a) Cis - isomer - Two identical atoms or group of atoms lie on the same side of double bond.

e.g. 

Cis - But - 2 - ene

b) Trans - isomer : Two identical atoms or group of atoms lie on the opposite side of double bond.

e.g.  1

Trans - But - 2 - ene.

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Model Answer And Scheme Marking Scheme

Std. XI **Sub. Physics**

Time : 3 Hrs. **Marks : 70**

Q.1 (d) - 30^0 1

Q.2 (d) - 90^0 1

Q.3 (a) - increase in density of air 1

Q.4 (b) - 10^4 1

Q.5 $0 < e \leq 1$ or $1 \geq e > 0$ 1

Q.6 1

$$\frac{(B_H)_A}{(B_H)_B} = \frac{B \cos \delta_A}{B \cos \delta_B} = \frac{\cos \delta_A}{\cos \delta_B}$$

$$= \frac{\cos 30^0}{\cos 45^0} = \frac{\sqrt{3}}{2} \times \sqrt{2}$$

$$= \frac{\sqrt{3}}{\sqrt{2}}$$

Q.7 Because of viscous force. 1

Q.8 $\sqrt{5}\ P$ 1

Q.9 Any to sign conventions (one mark each) 2

Q.10 $\tau = PE \sin \theta$ ½

$$E = \frac{\tau}{(2l)\ q} = \frac{3.5 \times 10^{-3}}{2 \times 10^{-2} \times 5 \times 10^{-6}}$$ ½

$E = 1.167 \times 10^4$ N/C 1

Q.11 $L_2 - L_1 = L_1\ \alpha\ (t_2 - t_1)$ ½

$= 10 \times 12 \times 10^{-6} (50 - 10)$ ½

$= 4800 \times 10^{-6}$ m $= 4.8 \times 10^{-3}$ m 1

Q.12 Definitions (one mark each) 2

OR

Q.12 $75 \times 10^4 + 5\%$ ohm 2

Q.13	Any two laws (one mark each)	2
Q.14	Any four characteristics (½ mark each)	2
Q.15	Explanation about ozone layer	1
	Importance	1

Q.16 $\vec{P} = \hat{i}\ P_x + \hat{j}\ P_y + \hat{k}\ P_z$ ½

$\vec{Q} = \hat{i}\ Q_x + \hat{j}\ Q_y + \hat{k}\ Q_z$

$\vec{P} \times \vec{Q} = (\hat{i}\ P_x + \hat{j}\ P_y + \hat{k}\ P_z) \times (\hat{i}\ Q_x + \hat{j}\ Q_y + \hat{k}\ Q_z)$ ½

$\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$ ½

$\hat{i} \times \hat{j} = \hat{k}$ $\qquad \hat{j} \times \hat{i} = -\hat{k}$

$\hat{j} \times \hat{k} = \hat{i}$ $\qquad \hat{k} \times \hat{j} = -\hat{i}$ ½

$\hat{k} \times \hat{i} = \hat{j}$ $\qquad \hat{i} \times \hat{k} = -\hat{j}$

$\vec{P} \times \vec{Q} = \hat{i}\ (P_y Q_z - P_z Q_y) + \hat{j}\ (P_z Q_x - P_x Q_z) + \hat{k}\ (P_x Q_y - P_y Q_x)$ 1

$$\vec{P} \times \vec{Q} = \begin{vmatrix} \hat{i} & \hat{j} & \vec{k} \\ P_x & P_y & P_z \\ Q_x & Q_y & Q_z \end{vmatrix}$$

Q.17	Circuit diagram	1
	Explanation	½
	$E = IR + Ir$	1
	$I = \dfrac{E}{R + r}$	½

Q.18 $V_0 = \sqrt{\dfrac{\gamma P_0}{\rho_0}}$ $\qquad V = \sqrt{\dfrac{\gamma P}{\rho}}$ ½

$\rho_0 = \dfrac{M}{v_0}$ $\qquad \rho = \dfrac{M}{v}$ ½

$\dfrac{V}{V_0} = \sqrt{\dfrac{PV}{P_0 V_0}}$ $\qquad$ but $PV = RT \quad P_0 V_0 = RT_0$ ½

½

$\dfrac{V}{V_0} = \sqrt{\dfrac{T}{T_0}}$ ½

$V \propto \sqrt{T}$ ½

Q.19 Principle / Statement ½

$dw = \vec{f} \cdot \vec{ds}$ ½

$dw = mv\,dv$ ½

$$w = \int_u^v dw$$

$$= \frac{1}{2} m (v^2 - u^2)$$ ½

$$= \frac{1}{2} mv^2 - \frac{1}{2} mu^2$$ ½

= change in K. E. ½

Q.20 Dimensions $[L^{-1}\ M^1\ T^{-1}]$ 1

$$x = \frac{[L_1^{-1}\ M_1^1\ T_1^{-1}]_{SI}}{[L_2^{-1}\ M_2^1\ T_2^{-1}]_{cas}}$$ ½

$$= \left[\frac{m}{cm}\right]^{-1} \left[\frac{kg}{g}\right]^{1} \left[\frac{s}{s}\right]^{-1}$$ ½

$$= \left[\frac{100\ cm}{cm}\right]^{-1} \left[\frac{1000\ g}{g}\right]^{1} \left[\frac{s}{s}\right]^{-1}$$ ½

$$= 10^{-2} \times 10^{3} \times 1$$ ½

$$1 \frac{Ns}{m^2} = 10 \text{ poise}$$

Q.21 For Bi - convex lens

$$\frac{1}{fa} = (\mu_g - 1) \left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$ ½

$$= \left(\frac{3}{2} - 1\right) \left(\frac{1}{24} + \frac{1}{32}\right)$$ ½

fa = 27.43 cm ½

$$\frac{1}{fw} = \left(\frac{\mu_g}{\mu_w} - 1\right) \left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$ ½

$$= \left(\frac{3/2}{4/3} - 1\right) \left(\frac{1}{24} + \frac{1}{32}\right)$$ ½

fw = 109.7 cm ½

Q.22 Diagram ½

$$F = \frac{1}{4\pi\varepsilon_0 k} \frac{qq_0}{x^2}$$ ½

$$d\,w = -F\,d\,x$$ ½

$$w = \int_{\infty}^{r} d\,w = \int_{\infty}^{r} - \frac{1}{4\pi\varepsilon_0 k} \frac{qq_o\,dx}{x^2}$$ ½

$$w = \frac{1}{4\pi\varepsilon_0 k} \frac{qq_0}{r}$$ ½

$v = w/q_0$

$$V = \frac{1}{4\pi\varepsilon_0 k} \frac{q}{r}$$ ½

OR

Q.22 Diagram ½

Explanation ½

$dw = -q_0 E\,dx$

$$\frac{dw}{q_0} = -E\,dx = dv$$ ½

$$E = -\frac{dv}{dx}$$ ½

Definition of potential gradient 1

Q.23 Mean = 2.62 s 1

Absolute error in each reading ½

Mean absolute error = Δ Am = 0.11 s ½

$$\text{Relative error} = \frac{\Delta Am}{Am} = 0.042$$ 1

Q.24 Diagram ½

Explanation ½

T = (mB) (NP) ½

$$\left.\begin{array}{l} NP = 2\,l \sin\theta \\ T = MB\sin\theta \end{array}\right\}$$ ½

Definition 1

Q.25 (i) $|\vec{A}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$ ½

$|\vec{A}| = \sqrt{14}$ ½

ii) $\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$ ½

Substitution ½

$\vec{A} \cdot \vec{B} = -3$ 1

Q.26 Any two factors (½ mark each) 1

$Q = kA \left(\frac{\Delta V}{\Delta x}\right) t$ 1

Definition of thermal conductivity 1

Q.27 i) 10 m/s 1

ii) part AB 1

iii) formula ½

Ans = 60 m ½

Any four characteristics (½ mark each) 2

OR

Q.27 i) $H_{max} = \frac{u^2 \sin^2\theta}{2g}$ ½

$= 10$ m ½

ii) $T = \frac{2u \sin\theta}{g}$ ½

$= 2.9$ s ½

iii) $R = \frac{u^2 \sin 2\theta}{g}$ ½

$= 69$ m ½

Any two assumptions (1 mark each) 2

Q.28	Diagram	½
	Explanation	½
	$dB = \frac{\mu_o}{4\pi}\left(\frac{I\,dl\sin\theta}{r^2}\right)$	½
	$dB = \frac{\mu_o}{4\pi}\frac{Id\,l}{r^2}$ ($\theta = 90^0$)	½
	$B = \int \frac{\mu_o}{4\pi}\frac{Id\,l}{r^2}$	½
	$B = \frac{\mu_o I}{2\,r}$	½
	Statement of rule	1
	SI unit - any two (½ mark each)	1
	OR	
	Diagram	½
	Explanation	½
	$F_1 = I\,b\,B$ $\quad F_2 = I\,b\,B$ $\quad F_1 = F_2$	½
	$\tau = F_1\left(\frac{a}{2}\right) + F_2\left(\frac{a}{2}\right) = I\,b\,B\,a$	½
	$\therefore\ \tau = I\,A\,B$	1
	Statement	1
	Vector form	1
Q.29	Prism formula	½
	For thin prism $\sin\theta \approx \theta$	½
	$\mu = \frac{(a+\delta)}{A}$	½
	$\delta = A(\mu - 1)$	½
	$(\mu - 1)$ is refractivity	½
	Refractivity $= (\mu - 1) = \delta/A$	½
	Snell's law	1
	Definition	1

OR

Q.29 $\omega = \frac{\delta v - \delta r}{\delta y}$ ½

$\delta v - \delta r = A\ (\mu_v - \mu_r)$ ½

$\delta y = A\,(\mu_y - 1)$ ½

$\omega = \frac{A\,(\mu_v - \mu_r)}{A\,(\mu_y - 1)}$ ½

$\omega = \frac{\mu_v - \mu_r}{\mu_y - 1}$ ½

The sky will appear black ½

Statement 1

Principle 1

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Model Answer And Scheme Marking Scheme

Std. XI **Sub. Mathematics**

Time : 3 Hrs. **Marks : 80**

Section A

Q.1 c) $1 - 2\sin^2\theta$

Q.2 b) $\dfrac{25}{3\sqrt{13}}$

Q.3 b) -9

Q.4 c) 2^n

Q.5 a) $-x\sin x + \cos x$

Q.6 a) $\dfrac{\sin 6x}{6} + \dfrac{\sin 2x}{2} + C$

Section B

Q.7 Let r be radius of circle, r = 15 cms

θ be angel substended by arc

$\theta = 108^0 = 108 \times \dfrac{\pi}{180} = \dfrac{3\pi}{180}$ radian 1

Length of arc $s = r\theta = 15\left(\dfrac{3\pi}{5}\right)$

$= 9\pi$ cms 1

Q.8 By Factorization formula

$\text{Sin } A - \sin B = 2\cos\left(\dfrac{A+B}{2}\right) . \sin\left(\dfrac{A-B}{2}\right)$

$\text{Sin } 5x - \sin 3x = 2\cos\left(\dfrac{5x+3x}{2}\right) .\sin\left(\dfrac{5x-3x}{2}\right)$ 1

$= 2\cos 4x . \sin x$ 1

OR

LHS $= \frac{1}{2}[2\sin(45^o + A) . \sin(45^o - A)$

$= \frac{1}{2}[\cos(45^o{+}A - 45^o + A) - \cos(45^o + A + 45^o - A)]$

$= \frac{1}{2}[\cos(2A) - \cos 90^o]$ 1

$= \frac{1}{2}\cos(2A)$ 1

Q.9 Equation of locus $3x^2 - 5xy + 6y^2 - 54 = 0$ .... (1) 1

Let (0, b) be a point on locus (1)

$\therefore\ 0 - 0 + 6b^2 - 54 = 0$ 1

$\therefore\ b = + 3$

$\therefore$ The coordinates of points on Y-axis are

(0,3) and (0, –3) 1

Q.10 Let $A(x_1, y_1) = (2, -3)$

$B(x_2, y_2) = (-3, 5)$ be end points of diameter of circle

$\therefore$ Equation of circle is $(x-x_1)(x-x_2) + (y-y_1)(y-y_2) = 0$

$\therefore\ (x - 2)(x + 3) + (y + 3)(y - 5) = 0$ 1

$\therefore\ x^2 + y^2 + x - 2y - 21 = 0$ 1

Q.11 $f(x) = x^2 - 6x + 11$

$= x^2 - 6x + 9 + 2$

$= (x - 3)^2 + 2$ 1

But for all $x \in R$, $x^2 > 0$

$\therefore\ (x - 3)^2 \geqslant 0$

$\therefore\ (x - 3)^2 + 2 \geqslant 0 + 2$

$\therefore\ f(x) \geqslant 2$

$\therefore$ Range $= [2, \infty)$ 1

Q.12 $\log(x+3) + \log(x-3) = \log 16$

$\therefore\ \log(x+3)(x-3) = \log 16$ .... by Law of Log

$\therefore\ \log(x^2 - 9) = \log 16$ 1

$\therefore\ x^2 - 9 = 16$

$\therefore\ x^2 = 25$

$\therefore\ x = + 5$

$\therefore$ but for logarithm $x \neq -5$

$\therefore\ x = 5$ 1

Q.13 Let δy, δu, δv be increaments in y, u, v respectively, corresponding to the increament δx in x.

As u and v are differentiable function of x.

$$\therefore \quad \frac{du}{dx} = \lim_{\delta x \to 0} \frac{\delta u}{\delta x} \text{ and } \frac{dv}{dx} = \lim_{\delta x \to 0} \frac{\delta v}{\delta x} \qquad 1$$

As $\delta x \to 0$, $\delta u \to 0$, $\delta y \to 0$ $\delta v \to 0$

Now $y = u + v$

$y + \delta y = u + v + \delta u + \delta v$

$\therefore \quad \delta y = \delta u + \delta v$ 1

dividing both sides by δx

$$\therefore \quad \frac{\delta y}{\delta x} = \frac{\delta u + \delta v}{\delta x}$$

Taking limit as $\delta x \to 0$

$$\therefore \quad \lim_{\delta x \to 0} \frac{\delta y}{\delta x} = \lim_{\delta x \to 0} \frac{\delta u}{\delta x} + \lim_{\delta x \to 0} \frac{\delta v}{\delta x}$$ As limits in RHs exist, the limit in LHS also exists.

$$\therefore \quad \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx} \qquad \{ \text{ from (1)} \qquad 1$$

Q.14 Let $I = \int \frac{\sin x}{1 - \sin x} \, dx$

$$= \int \frac{\sin x}{1 - \sin x} \times \frac{1 + \sin x}{1 + \sin x} \, dx$$

$$= \int \frac{\sin x + \sin^2 x}{1 - \sin^2 x} \, dx$$

$$= \int \frac{\sin x + \sin^2 x}{\cos^2 x} \, dx \qquad 1$$

$$= \int \left(\frac{\sin x}{\cos^2 x} + \frac{\sin^2 x}{\cos^2 x} \right) dx$$

$$= \int \sec x \,.\, \tan x \, dx + \int (\sec^2 x - 1) \, dx$$

$$= \sec x + \tan x - x + c \qquad 1$$

Section C

Q.15 $\tan\theta = -\frac{4}{3}$

$\therefore \sec^2\theta = 1 + \tan^2\theta = 1 + \left(\frac{-4}{3}\right)^2 = \frac{25}{9}$ 1

$\therefore \sec\theta = + 5/3$

But θ lies in fourth quadrant

$\therefore \sec\theta$ is positive

$\therefore \sec\theta = 5/3$ 1

$\therefore 3\sec\theta + 5\tan\theta = 3(5/3) + 5\left(\frac{-4}{3}\right)$

$= \frac{-5}{3}$ 1

OR

$$\text{LHS} = \frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta}$$

$$= \frac{\sin^2\theta + (1+\cos\theta)^2}{(1+\cos\theta)\sin\theta}$$ 1

$$= \frac{1 + (\sin^2\theta + \cos^2\theta) + 2\cos\theta}{(1+\cos\theta)\sin\theta}$$

$$= \frac{2 + 2\cos\theta}{(1+\cos\theta)\sin\theta}$$ 1

$$= \frac{2(1+\cos\theta)}{(1+\cos\theta)\sin\theta}$$

$$= \frac{2}{\sin\theta}$$

$= 2\,\text{cosec}\,\theta$ 1

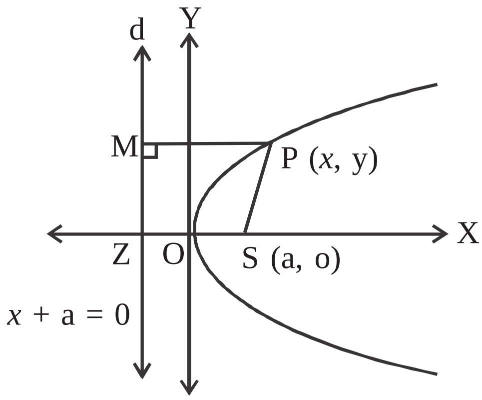
$=$ R.H.S.

Q.16 Let s be focus and d be directrix of the parabola

Draw sz perpendicular to directrix

Let O be mid point of SZ, considered as origin, Let us consider X - axis along OS and Y - axis perpendicular to OS, through O

Let OS = a $\quad\therefore$ S (a, 0)



Equation of directrix is $x + a = 0$ 1

Let P (x, y) be a point on parabola

Draw PM perpendicular to directrix

$\therefore$ SP = PM

$$\therefore \sqrt{(x-a)^2 + (y-0)^2} = \left| \frac{1.x + o + a}{\sqrt{1^2 + o^2}} \right|$$ 1

$$\therefore \sqrt{x^2 - 2ax + a^2 + y^2} = |x + a|$$

By squaring both sides

$$\therefore x^2 - 2ax + a^2 + y^2 = x^2 - 2ax + a^2$$

$$\therefore y^2 = 4ax$$

This equation of parabola in standard form 1

Q.17 Given Inequation $2x + 3y < 6$ .... (1)

$x + y > 2$ .... (2)

$x > 0, \ y > 0$ .... (3)

From (1) boundary line $2x + 3y = 6$

This line passes through (3, 0) and (0, 2)

put $x = y = 0$ in (1)

$\therefore$ $0 < 6$ (true)

Solution set is on origin side 1

From (2) boundry Line $x + y = 2$

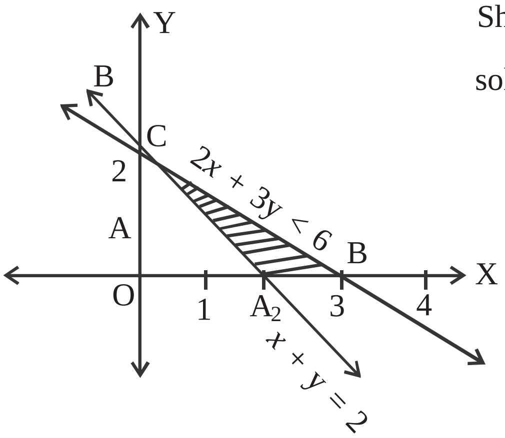
This line passes through (2, 0) and (0, 2)

put $x = y = 0$ in (2)

$\therefore$ $0 > 2$ (not true)

$\therefore$ Solution set is non origin side 1

From (3) $x > 0$, $y > 0$ is the solution set in first quadrant 1



Shaded region ABC is feasible solution of given inequations 1

Q.18 Here $f(x) = x^2 + 3x + 2$

$f(-1) = (-1)^2 + 3(-1) + 2$

$= 1 - 3 + 2$

$= 0$ 1

Since $f(x) = f(-1)$

$x^2 + 3x + 2 = 0$

$(x + 1)(x + 2) = 0$ 1

$x + 1 = 0$ or $x + 2 = 0$

$x = -1$ or $x = -2$ 1

The required value of x is -2

Q.19 LHS $= \lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a}$

put $x = a + h$ As $x \to a$, $h \to 0$

LHS $= \lim\limits_{h \to o} \dfrac{(a + h)^n - a^n}{a + h - a}$ 1

$= \lim\limits_{h \to o} \dfrac{\cancel{a^n} + na^{n-1} n + \dfrac{n(n-1)}{21} a^{n-2} + h^2 + \ldots\ldots. h^2 - \cancel{a^n}}{h}$ 1

1

$$= \lim_{h \to o} \frac{h\,[na^{n-1} + \frac{n\,(n-1)}{21}\,a^{n-2} + h + \,.......\, h^{n-1}]}{h}$$ 1

$$= \lim_{h \to o} (na^{n-1} + \frac{n\,(n-1)}{21}\,a^{n-2}\,h + \,.......\, h^{n-1})$$ 1

$$= na^{n-1} + o + \,..........\, + 0$$

$$= na^{n-1}$$

$$= \text{RHS}$$ 1

OR

$$\text{Let } L = \lim_{x \to o} \frac{\sin(a + x) + \sin(a - x) - 2\sin a}{x \sin x}$$

$$= \lim_{x \to o} \frac{2\sin a \cos x - 2\sin a}{x \sin x}$$ 1

$$= \lim_{x \to o} - 2\sin a\,\frac{(1 - \cos x)}{x\,.\,x} \times \frac{x}{\sin x}$$

$$= - 2\sin a \lim_{x \to o} \frac{1 - \cos x}{x^2} \times \frac{1}{\lim_{x \to o} \frac{\sin x}{x}}$$ 1

$$= - 2\sin a\,\frac{1}{2} \times \frac{1}{1}$$

$$= - \sin a$$ 1

Q.20

x_i	f_i	$f_i\,x_i$	$f_i x_i^2$
1	a	a	a
2	2a	4a	8a
3	3a	9a	27a
4	4a	16a	64a
5	5a	25a	125a
	N = 15 a	Σ = 55a	Σ = 225a

1

Here N = 15 a

Mean $\bar{x} = \frac{1}{N} \Sigma \; f_i x_i = \frac{1}{15\ a} \quad (55a) = \frac{11}{3}$ 1

S.D. $\sigma = \sqrt{\frac{\Sigma\ f_i x_i^2}{N} - (\bar{x})^2}$

$= \sqrt{\frac{225\ a}{15\ a} - \left(\frac{11}{3}\right)^2}$

$= \sqrt{15 - \frac{121}{9}}$

$= \frac{1}{3} \sqrt{14}$

$= 1.2472$ 1

Section D

Q.21 We know that $1 + \cos 2\theta = 2\cos^2\theta$

$1 + \cos 8\theta = 2\cos^2 4\theta$

L.H.S. $= \sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$

$= \sqrt{2 + \sqrt{2 + \sqrt{2\ (1 + \cos 8\theta)}}}$

$= \sqrt{2 + \sqrt{2 + \sqrt{2.2\cos^2 4\theta}}}$ 1

$= \sqrt{2 + \sqrt{2 + 2\cos 4\theta}} = \sqrt{2 + \sqrt{2\ (1 + \cos 4\theta)}}$

$= \sqrt{2 + \sqrt{2.2\cos^2 2\theta}}$ 1

$= \sqrt{2 + 2\cos 2\theta}$

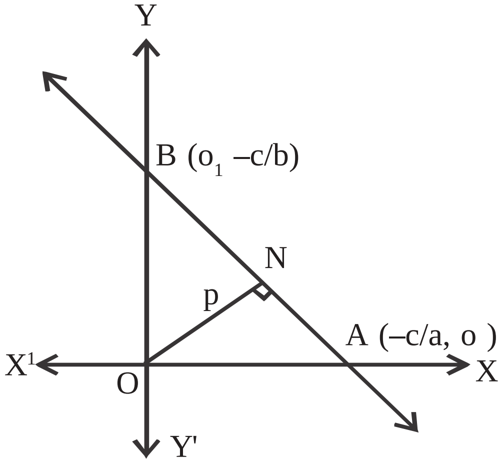
$= \sqrt{2\ (1 + \cos 2\theta)}$

$= \sqrt{2.2\cos^2\theta}$ 1

$= 2\cos\theta$

= RHS 1

Q.22 Equation of line $ax + by + c = 0$ ...... (1)



Let ON = p = perpendicular distance from origin to the line .... (1)

Let the line (1) cuts X - axis in A and Y axis in B

For Point A, put Y = 0 in (1)

$ax + c = 0$

$x = -{}^{c}/_{a}$

$\therefore$ A is $(-{}^{c}/_{a}, o)$

$\therefore$ $OA = \left| -\dfrac{c}{a} \right|$

For point B, put $x = 0$ in (1)

$O + by + c = o$

$y = -{}^{c}/_{b}$

$\therefore$ B is $(o, -{}^{c}/_{b})$ 1

$\therefore$ $OB = |-{}^{c}/_{b}|$

By distance formula

$$AB = \sqrt{\left(-\frac{c}{a} - o\right)^2 + \left(o + \frac{c}{a}\right)^2}$$

$$AB = \left|\frac{c}{ab}\right| \sqrt{a^2 + b^2}$$ 1

Now Area (Δ OAB) $= \dfrac{1}{2}$ AB.ON

$= \dfrac{1}{2}\left|\dfrac{c}{ab}\right|\sqrt{a^2+b^2}\ P$ (2)

Also Area (Δ OAB) $= \dfrac{1}{2}$ OA.OB

$= \dfrac{1}{2}\left|-\dfrac{c}{a}\right|\left|-\dfrac{c}{b}\right|$

$= \dfrac{1}{2}\left|\dfrac{c^2}{|ab|}\right|$ (3) 1

From (2) and (3), we have

$$\frac{1}{2}\left|\frac{c}{ab}\right|\sqrt{a^2+b^2} \quad P = \frac{1}{2}\left|\frac{c^2}{|ab|}\right|$$

$\therefore \quad P = \left|\dfrac{c^2}{\sqrt{a^2+b^2}}\right|$ 1

OR

Let $u = x - 5y - 17 = 0$

$v = 8x + 3y - 7 = 0$ be the intersecting lines we know that

$u + kv = 0$ represents a line passes through the intersection of $u = 0$ and $v = 0$

$\therefore \quad (x - 5y - 17) + k(8x + 3y - 7) = 0 \qquad (1)$ 1

$\therefore \quad (1 + 8k)x + (-5 + 3k)y - 17 - 7k = 0$

Now X–intercept $= -\dfrac{(-17 - 7k)}{1 + 8k} = \dfrac{17 + 7k}{1 + 8k}$

Y – intercept $= -\dfrac{(-17 - 7k)}{-5 + 3k} = \dfrac{17 + 7k}{-5 + 3k}$ 1

Here X-intercept = Y – intercept

$$\frac{(-17 - 7k)}{1 + 8k} = \frac{17 + 7k}{-5 + 3k}$$

$1 + 8k = -5 + 3k$

$5k = -6$

$k = -\dfrac{6}{5}$ putting in (1), we get 1

$(x - 5y - 17) - \dfrac{6}{5}(8x + 3y - 7) = 0$

$-43x - 43y - 43 = 0$

$x + y + 1 = 0$ 1

This is equation of required line

Q.23 Let $\bar{a} = \hat{i} + \hat{j} + \hat{k}$

$\bar{b} = -2\hat{i} + 4\hat{j} + 3\hat{k}$

$\bar{c} = -\hat{i} + 5\hat{j} + 5\hat{k}$

$\bar{d} = 2\hat{i} + 2\hat{j} + 6\hat{k}$ be p.v. of points A, B, C, D respectively

$\overline{AB} = -3\hat{i} + 3\hat{j} + 2\hat{k}$, $\overline{CD} = 3\hat{i} - 3\hat{j} + \hat{k}$ 1

$$\overline{AB} \times \overline{CD} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -3 & 3 & 2 \\ 3 & -3 & 1 \end{vmatrix} = 9\hat{i} + 9\hat{j} = 9\,(\hat{i} + \hat{j})$$

$|\overline{AB} \times \overline{CD}| = 9\sqrt{1^2+1^2} = 9\sqrt{2}$ 1

Now unit vectors perpendicular to $\overline{AB}$ and $\overline{CD}$ is

$$\hat{n} = + \frac{\overline{AB} \times \overline{CD}}{|AB \times CD|}$$

$$= + \frac{9\,(\hat{i}+\hat{j})}{9\sqrt{2}}$$

$$= + \frac{(\hat{i}+\hat{j})}{\sqrt{2}}$$ 1

$\therefore$ Vectors of magnitude 4 perpendicular to $\overline{AB}$ and $\overline{CD}$ are

$$\bar{n} = + 4\hat{n}$$

$$= + \frac{4(\hat{i}+\hat{j})}{\sqrt{2}}$$ 1

OR

Let $\overline{R}$ be the resultant of the forces $\overline{F}_1, \overline{F}_2, \overline{F}_3$

$\therefore \overline{R} = \overline{F}_1 + \overline{F}_2 + \overline{F}_3$

$= 6\hat{i} + \hat{j} + 3\hat{k}$ 1

Let $\bar{a} = \hat{i} + 2\hat{j} + 4\hat{k}$

$\bar{b} = 3\hat{i} + 4\hat{j} + 7\hat{k}$ be p.v. of points A and B respectively

$\therefore \overline{AB} = \bar{b} - \bar{a}$

$= 2\hat{i} + 2\hat{j} + 3\hat{j}$ 1

Now Total work done by these forces = work done by their resultant

$= \overline{R} \cdot \overline{AB}$ 1

$= (6\hat{i} + \hat{j} + 3\hat{k}) \cdot (2\hat{i} + 2\hat{j} + 3\hat{k})$

$= 12 + 2 + 9$

$= 23$ units 1

Q.24 $D = \begin{vmatrix} 2 & -1 & 3 \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{vmatrix} = 2(1+1) + (1-1) + 3(-1-1) = -2$

$D_x = \begin{vmatrix} 9 & -1 & 3 \\ 6 & 1 & 1 \\ 2 & -1 & 1 \end{vmatrix} = 9(1+1) + 1\ (6-2) + 3\ (-6-2) = -2$ 1

$D_y = \begin{vmatrix} 2 & 9 & 3 \\ 1 & 6 & 1 \\ 1 & 2 & 1 \end{vmatrix} = 2(6-2) - 9\ (1-1) + 3\ (2-6) = -4$

$D_z = \begin{vmatrix} 2 & -1 & 9 \\ 1 & 1 & 6 \\ 1 & -1 & 2 \end{vmatrix} = 2(2+6) + 1\ (2-6) + 9\ (-1-1) = -6$ 1

By Cramer's rule

$x = \frac{Dx}{D} = \frac{-2}{-2} = 1$ 1

$y = \frac{Dy}{D} = \frac{4}{-2} = 2$

$z = \frac{Dz}{D} = \frac{-6}{-2} = 3$

$\therefore\ x = 1,\quad y = 2,\quad z = 3$ 1

Q.25 Here $(A+B) \cdot (A-B) = A^2 - B^2$

$A^2 - AB + BA - B^2 = A^2 - B^2$

$\therefore\ -AB + BA = 0$

$\therefore\ AB = BA$ 1

$\therefore \begin{bmatrix} -3 & 2 \\ 2 & -4 \end{bmatrix} \begin{bmatrix} 1 & x \\ y & 0 \end{bmatrix} = \begin{bmatrix} 1 & x \\ y & 0 \end{bmatrix} \begin{bmatrix} -3 & 2 \\ 2 & -4 \end{bmatrix}$ 1

$\therefore \begin{bmatrix} -3+2y & -3x+0 \\ 2-4y & 2x-0 \end{bmatrix} = \begin{bmatrix} -3+2x & 2-4x \\ -3y & 2y-0 \end{bmatrix}$ 1

By equality of matrices

$-3 + 2y = -3 + 2x$ (1)

$2 - 4y = -3y$ (2)

$-3x = 2 - 4x$ (3)

$2x = 2y$ (4)

From (2), $y = 2$

From (3), $x = 2$ 1

These values of x and y satisfies equation (1) and (4)

$\therefore \quad x = 2, \quad y = 2$ 1

Q.26 Let $\sqrt{2+2\sqrt{3}\,i} = x + iy, \quad x, y \in R$

squaring both sides

$2 + 2\sqrt{3}\,i = (x + iy)^2$

$= x^2 + i^2y^2 + 2xyi$

$= (x^2 - y^2) + 2xyi$ 1

By equality of complex numbers

$x^2 - y^2 = 2$ (1)

$2xy = 2\sqrt{3}$

$xy = \sqrt{3}$ (2)

$y = \dfrac{\sqrt{3}}{x}$ putting in (1)

$x^2 - \dfrac{3}{x^2} = 2$

$\therefore \quad x^4 - 3 = 2x^2$

$\therefore \quad x^4 - 2x^2 - 3 = 0$ 1

$\therefore \quad (x^2 - 3)(x^2 + 1) = 0$

$\therefore \quad x^2 = 3$ or $x^2 = -1$ but $x \in R$

$\therefore \quad x^2 = 3$ $x^2 \neq -1$

$\therefore \quad x^2 = 3$

$\therefore \quad x = +\sqrt{3}$ 1

when $x = \sqrt{3}$, from (2) $y = \dfrac{\sqrt{3}}{\sqrt{3}} = 1$

when $x = -\sqrt{3}$, from (2) $y = \dfrac{\sqrt{3}}{-\sqrt{3}} = -1$

$\therefore \sqrt{3} + i$ or $-\sqrt{3} - i$ are the square roots of given complex number

$\therefore \sqrt{2 + 2\sqrt{3}\, i} = + (\sqrt{3} + i)$ 1

Q.27 Let four numbers in A.P. be

$a - 3d, \quad a - d, \quad a + d, \quad a + 3d$

From the given conditions

$(a-3d) + (a + 3d) = 8 \qquad (1)$

& $\quad (a - d)(a + d) = 12 \qquad (2)$ 1

From (1) $\quad 2a = 8$

$a = 4$

From (2) $\quad a^2 - d^2 = 12$

$4^2 - d^2 = 12$

$d^2 = 4$

$d = + 2$ 1

When $a = 4$ and $d = 2$, the numbers are

$a - 3d = 4 - 3(2) \quad = \quad -2$

$a - d = 4 - 2 \quad = \quad 2$

$a + d = 4 + 2 \quad = \quad 6$

$a + 3d = 4 + 6 \quad = \quad 10$ 1

When $a = 4$, and $d = -2$, the numbers are 10, 6, 2, –2

$\therefore$ Four numbers in A.P. are –2, 2, 6, 10 –

Q.28 We know that $\quad {}^{n}P_{r} = \dfrac{n!}{(n-r)!}$

Now ${}^{(x+y)}P_2 = 56$

$$\frac{(x + y)!}{(x + y - 2)!} = 56$$

$$\frac{(x + y)(x+y-1)(x + y - 2)!}{(x + y - 2)!} = 56$$ 1

$(x + y)(x + y - 1) = 56$

$\therefore \quad (x + y)(x + y - 1) = 8.7$

$\therefore \quad x + y = 8 \qquad (1) \qquad 1$

Also $\quad {}^{(x-y)}P_2 = 12$

$$\frac{(x - y)!}{(x - y - 2)!} = 12$$

$$\frac{(x - y)(x - y - 1)(x + y - 2)!}{(x + y - 2)!} = 12$$

$\therefore \quad (x - y)(x - y - 1) = 12$

$= 4.3$

$\therefore \quad x - y = 4 \qquad (2) \qquad 1$

Solving (1) and (2), we get

$2x = 12$

$x = 6$ put in (1)

$6 + y = 8$

$y = 2$

$\therefore x = 6$ and $y = 2$ 1

Q.29 Let $P(n) = 1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \dfrac{n(n+1)(2n+1)}{6}$

Step I : For n = 1

LHS = $P(1) = 1^2 = 1$

$$\text{RHS} = \frac{n(n+1)(2n+1)}{6} = \frac{1(1+1)(2+1)}{6} = \frac{2 \times 3}{6} = 1$$

$\therefore$ LHS = RHS

$\therefore$ P(1) is true 1

Step II : Let P (k) is true

$\therefore \quad 1^2 + 2^2 + 3^3 + \ldots\ldots\ldots\ldots + k^2 = \dfrac{k(k+1)(2k+1)}{6} \quad \ldots\ldots\ldots (1)$

We have to prove that P (k + 1) is true

i.e. to prove that $1^2 + 2^2 + 3^3 + \ldots\ldots\ldots\ldots + k^2 + (k + 1)^2 = \dfrac{(k+1)(k+2)(2k+3)}{6}$

Now LHS $= 1^2 + 2^2 + 3^3 + \ldots\ldots\ldots\ldots + k^2 + (k+1)^2$

$= [1^2 + 2^2 + 3^3 + \ldots\ldots\ldots\ldots + k^2] + (k+1)^2$

$= \left[\dfrac{k(k+1)(2k+1)}{6}\right] + (k+1)^2$ .... from (1)

$= \dfrac{k(k+1)(2k+1) + 6(k+1)^2}{6}$ 1

$= \dfrac{(k+1)[k(2k+1) + 6(k+1)]}{6}$

$= \dfrac{(k+1)[2k^2 + k + 6k + 6]}{6}$

$= \dfrac{(k+1)[2k^2 + 7k + 6]}{6}$

$= \dfrac{(k+1)(k+2)(2k+3)}{6}$

= RHS

$\therefore$ P (k + 1) is true 1

$\therefore$ From step I and II by principle of mathematical induction

P (n) is true, for $n \in N$

$\therefore$ $1^2 + 2^2 + 3^3 + \ldots\ldots\ldots\ldots + n^2 + \dfrac{n(n+1)(2n+1)}{6}$, for all $n \in N$ 1

OR

Q.29 $(0.98)^{-3} = (1 - 0.02)^{-3}$

$= 1 + (-3)(-0.02) + \dfrac{(-3)(-3-1)}{2!}(-0.02)^2$

$+ \dfrac{(-3)(-3-1)(-3-2)}{3!}(-0.02)^3 + \ldots\ldots\ldots\ldots\ldots\ldots$ 1

$= 1 + 0.06 + \dfrac{1}{2}(-3)(-4)(4 \times 10^{-4}) + \dfrac{1}{6}(-3)(-4)(-5)(-8 \times 10^{-6})$

$= 1 + 0.06 + 0.0024 + 0.00008$ 1

$= 1 + 0.06 + 0.0024 + 0.0001$ 1

$= 1.0625$ 1

Q.30 $n(S) = {}^{52}C_1 = 52$

A : a club card is drawn

B : an ace card is drawn

$\therefore$ $A \cap B$: The card drawn is the ace of club.

$n(A) = {}^{13}C_1 = 13$

$P(A) = \dfrac{n(A)}{n(S)} = \dfrac{13}{52} = \dfrac{1}{4}$ 1

$n(B) = {}^{4}C_1 = 4$

$P(B) = \dfrac{4}{52} = \dfrac{1}{13}$

Now $n(A \cap B) = 1$

$P(A \cap B) = \dfrac{n(A \cap B)}{n(S)} = \dfrac{1}{52}$ ....(1) 1

Also $P(A) \quad P(B) = \dfrac{1}{4} \times \dfrac{1}{13}$

$= \dfrac{1}{52}$ ....(2) 1

From (1) and (2), we get

$P(A \cap B) = P(A) \quad P(B)$

$\therefore$ A and B are independent event 1

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Model Answer Paper

Std. XI **Sub. Biology**

Time : 3 Hrs. **Marks : 70**

Section A

Select the most appropriate answer from the given multiple choices and write the complete sentence.

1. Simple lipids are esters of ———————— (1)

   a. fatty acids with glycerols

2. —— are small, circular ssRNAs without a protein coat. (1)

   a. Viroids

3. In the ventral nerve cord of cockroach, there are _____ ganglia present. (1)

   d. 9

4. Which one the following is not a synovial joint? (1)

   b. Intervertebral

Answer the following questions in one sentence each:

5. 'Mangifera Indica' Write the given scientific name correctly using binomial system of nomenclature, the author is Linnaeus. (1)

   Ans - Mangifera Indica L.

   (½ mark for name ½ mark for abbreviation of author's name)

6. Why the person suffering from Marasmus has dry, thin and wrinkled skin.

   Ans - Due to protein deficiency, stored fats are used for respiration. Subcutaneous fat disappears. (1)

   (protein deficiency ½ M, disappearance of subcutaneous fat ½ M)

7. Give role of synovial fluid. (1)

   (lubrication of bones at the joint - 1 mark)

8. What are ommatidia ? (1)

   (Smaller units of compound eye of Cockroach 1M)

Section B

Answer the following questions in short:

9. Give an account of non-genetic RNA. (2)

   (Mentioning of three types 1M, Description of any two types 1M)

10. What is cytokinesis? How it differs in plant and animal cells. (2)

    (Definition 1M, Difference 1M)

11. Describe the role of

    a. Disulphide bonds

    b. Phospho-di-estcr bonds (2)

    (Correct role of Disulphide bond in proteins 1M, Phospho-di-ester bonds in DNA 1M)

12. Describe the role of hydathode. (2)

    (Any two points 1M each.)

13. Write symbols for the following: bisexual flower, Corolla, androecium, inferior ovary. (2)

    (Four correct symbols ½ M **each, total 2M) ___ _.__.. ___ _ ⚥ , C, A, G.**

14. Justify: A body will get adversely affected if liver stops functioning? (2)

    (Any four correct functions of liver, ½ M each, total 2M)

15. Sketch and label areolar connective tissue. (2)

    (diagram ½ mark, 1½ marks any three correct labels)

16. How mitochondria help in aerobic respiration?

    (ETS, generation of ATP, role in Krebs cycle,; Oxygen utilizing enzymes, conversion of pyruvate; any 2 points 1 mark each.)

17. Which pH will favor action of pepsin and trypsin? (2)

    (Pepsin works in acidic pH whereas trypsin needs alkaline pH ; 1 mark each)

18. Justify, “all vertebrates are chordates but all chordates are not vertebrates” (2)

    (Any two reasons, 1M each)

OR

Why can’t the reptiles fly?

(Absence of wings, non-streamlined body, solid bones. Any two points 1 mark each)

Section C

Answer the following questions in short:

19. Sketch cell cycle and briefly explain the G1, S and G2 phases.

    (Any six correct points ½ M each, total 3M)

20. Explain symplast pathway of movement of water from the soil to root xylem.. (3)

    (Any four correct points ½ M each, total 2 M, proportionate diagram ½ M one correct label ½ M)

21. Write functions of the following modifications: (3)

    a. Cladode

    b. Leaf hooks

    c. Corm

    d. Thorn

    e. Sucker

    f. Bulbil

    (For one correct function of each modification ½ M)

22. Write salient features of Division Bryophyta with respect to its roots, vegetative reproduction and alternation of generation. (3)

    (Root-Description of rhizoids 1 M, Veg. rep.-tuber and gemma 1 M, Alternation of generation-heteromorphic with dominant gametophyte 1 M)

23. Prawns and spiders belong to the same phylum. Give the characteristic feature of phylum to which they belong. (3)

    (Name of the correct phylum ½ Mark, any five correct points ½ M each, total 2½M)

24. Tissue in salivary glands and epidermis of skin both are epithelial type. But still they are different from each other. Make a note of these differences. (3)

    (Any three differences 1M each.)

25. "Cockroach exhibits sexual dimorphism".? Explain the statement. (3)

    (Any three points 1M each)

26. Identify the types of joints in the following examples. (3)

    a. Glenoid cavity and humerus ⟶ ball and socket

    b. Pubic bones ⟶ symphysis

    c. Atlas and axis ⟶ pivot

    (1 mark each)

OR

26 Triceps and biceps in the upper arm are necessary for the movement of lower arm. Explain how do they work?

(Antagonistic muscle 1 mark; flexion and extension 1 mark each)

27 Give one function each of vacuole, plasmid, and lysosome.

(Any one function of vacuole, plasmid, lysosome 1 M each; total 3M)

Section D

Answer the following questions:

28. Give an account of vascular bundles

(Any 5 types - names 2½ marks, description 2½ marks)

OR

Describe different types of Placentation.

(Any 5 types - names 2½ marks, description 2½ marks)

29. What is germination? Explain the type of seed germination shown by the mangroves. Give its suitable example. (5)

(Definition 1 mark; Any 2 points explaining the process of Vivipary, ½ Mark for each point; total 2 M, Any one correct example 1 M.) (2 + 2 + 1)

OR

Draw growth curve. Explain the three Phases of growth. (5)

(Diagram: Proportionate curve ½ M, 1½ M, for correct labels, total 2M. Explanation containing any two valid points for each phase of growth 1M. each, total 3M) (2 + 3)

30. Define the terms - A. Vital capacity B- Tidal volume C-Total lung capacity. When a person is climbing a hill, how his respiration is regulated? (5)

(Three definitions 1M each total 3 M, explanation 2M) (3 + 2)

OR

When you are climbing a hill, you begin to breathe quicker. How is it regulated?

(Role of oxygen and carbon dioxide sensors. 1M, Role of rhythm center and pneumotactic center 2M each.) (1 + 2 + 2)

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