PYRAMID

IIT-JEE | MEDICAL | FOUNDATION

JEE TEST PAPER

Time : 3 Hrs.   **Max. Marks : 300**

Important Instructions :

1. The test is of 3 hour duration and Test Booklet contains 90 questions. For Multiple Choice question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. For **Integer Types question** carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, **one** mark will be deducted.

2. Use Black Ball point Pen only for writing particulars on this page/marking responses.

3. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

4. On completion of the test, the candidate must handover the Answer Sheet to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.

5. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.

7. Each candidate must show on demand his/her Admission Card to the Invigilator.

8. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

9. Use of Electronic/Manual Calculator is prohibited.

10. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.

11. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

Name of Student : _____

PART 1 - PHYSICS

1. A boy is standing on a flatcar that is moving with uniform acceleration on a level track. At the instant when flatcar is moving with velocity 10 m/s due east, the boy throws a ball with velocity 20 m/s in direction 45° above the east with respect to the flatcar in plane of motion of flatcar. What should be the acceleration of the flatcar so that the boy can catch the ball without moving anywhere on the flatcar? Assume acceleration due to gravity 10 m/s².

   (A) 10 m/s² eastwards

   (B) 10 m/s² westwards

   (C) 20 m/s² eastwards

   (D) 20 m/s² westwards

2. Find the speed of the ring as a function of 'θ' if rope is pulled down with constant speed u :-
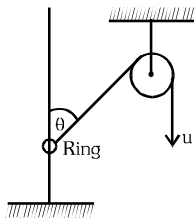
   (A) $\dfrac{u}{\sin\theta}$ (B) $\dfrac{u}{\cos\theta}$

   (C) $\dfrac{u}{2\sin\theta}$ (D) $\dfrac{u}{2\cos\theta}$

3. A small ball can move in a vertical plane along a semicircle of radius r without friction. At what speed is the ball to launch from point A so that its acceleration is 3g at point B ?
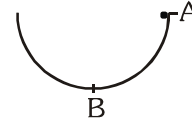

   (A) $(3gr)^{1/2}$ (B) $(2gr)^{1/2}$

   (C) $(gr)^{1/2}$ (D) $2(gr)^{1/2}$

4. A block of mass m sliding on a horizontal frictionless surface has kinetic energy K. It collides head on with another stationary identical block. The collision is perfectly inelastic. How much energy is lost in this collision?

   (A) K/4   (B) K/2   (C) K/3   (D) 3K/4

5. A cubical block of side L rests on a rough horizontal surface with coefficient of friction μ. A horizontal force F is applied on the block as shown. If the coefficient of friction is sufficiently high so that the block does not slip before toppling, the minimum force required to topple the block is
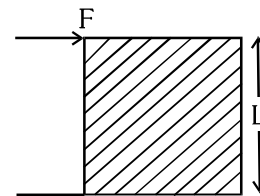

   (A) Infinitesimal   (B) mg/4

   (C) mg/2   (D) mg(1 – μ)

6. Given structure is lying in vertical plane and is hinged at x. Structure is made up of 2 identical rods with mass M & length L each. Initially it is at rest and released. Initially, one of the rods of the structure is vertical and the other horizontal.Initial angular acceleration about x is

X
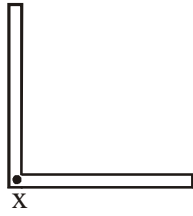
(A) $\left(\dfrac{3g}{10L}\right)$ (B) $\left(\dfrac{g}{5L}\right)$

(C) $\left(\dfrac{6g}{8L}\right)$ (D) $\left(\dfrac{g}{2L}\right)$

7. Three rods made of same material & having the same cross section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at 0°C & 90°C respectively. The temperature of the junction of the three rods will be :
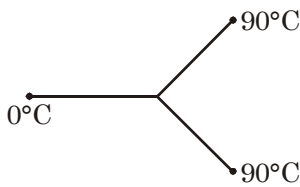

(A) 45°C   (B) 60°C

(C) 30°C   (D) 20°C

8. Assuming Newton's law of cooling to be valid. The temperature of body changes from 60°C to 40°C in 7 minutes. Temperature of surroundings being 10°C, its temperature after next 7 minutes, is :-

(A) 7°C   (B) 14°C

(C) 21°C   (D) 28°C

9. A carnot engine works between the temperature of 1092 K to 273 K is used as heat pump. It consumes 1260 watt of electrical energy and heat is extracted from the sink containing water at 0°C. Find the rate of freezing of water :-

(A) 1.25 gm/sec   (B) 2 gm/sec

(C) 3 gm /sec   (D) 5 gm/sec

10. A liquid film is formed over a frame ABCD as shown in figure. A massless wire CD can slide without friction. The mass to be hung from CD to keep it in equilibrium is (Surface tension of liquid is T)
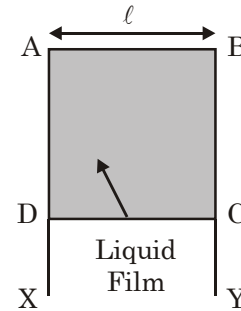

(A) Tℓ/g   (B) 2Tℓ/g
(C) g/2Tℓ (D) Tℓ/2g

11. A spherical cavity of radius r is made in a conducting sphere of radius 2r. A charge q is kept at the centre of cavity as shown in the figure. Find the magnitude of the total electric field at (4r, 0, 0).
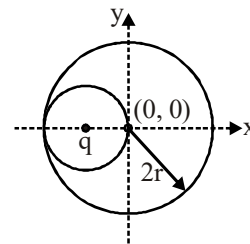

(A) $\dfrac{Kq}{16r^2}$ (B) $\dfrac{4Kq}{r^2}$

(C) $\dfrac{Kq}{25r^2}$ (D) $\dfrac{4Kq}{9r^2}$

12. A planet of mass m moves around the sun of mass M in an elliptical orbit. The maximum and minimum distances of the planet from the sun are r_1 and r_2 respectively. Therefore, the time period of the planet is proportional to
(A) $(r_1 + r_2)^3$ (B) $(r_1 + r_2)^{3/2}$
(C) $(r_1 + r_2)^{2/3}$ (D) $(r_1 + r_2)^4$

13. Full scale deflection current for galvanometer is 1 mA. What should be the value of shunt resitance (approximately) so that galvanometer shows half scale deflection for the circuit shown.
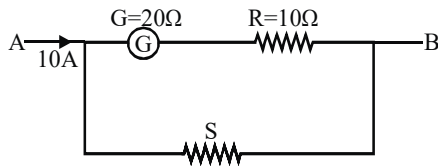

(A) 1.5 mΩ   (B) 3mΩ
(C) 10 mΩ   (D) 15 mΩ

14. The figure shows a conducting loop ABCDA placed in a uniform magnetic field (strength B) perpendicular to its plane. The part ABC is the $(3/4)^{th}$ portion of the square of side length ℓ. The part ADC is a circular arc of radius R. The points A and C are connected to a battery which supply a current I to the circuit. The magnetic force on the loop due to the field B is
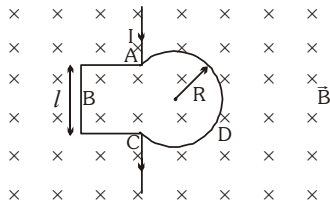

(A) Zero   (B) BIℓ (C) 2BIR   (D) $\dfrac{BI\ell R}{\ell + R}$

15. A time varying uniform magnetic field passes through a circular region of radius R. The magnetic field is directed outwards and it is a function of radial distance 'r' and time 't' according to relation B = B_0rt. The induced electric field strength at a radial distance R/2 from the centre will be

(A) $\dfrac{B_0 R^2}{12}$ (B) $\dfrac{B_0 R^2}{6}$ (C) $\dfrac{2B_0 R^2}{3}$ (D) $\dfrac{B_0 R^2}{16}$

16. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3 Ω, L = 25.48 mH, and C = 796 μF. The power factor is :

(A) 0.4   (B) 0.6   (C) 0.8   (D) 0.3

17. In a hydrogen atom, electron moves from second excited state to first excited state and then from first excited state to ground state. The ratio of wavelengths is -

(A) $\dfrac{20}{3}$ (B) $\dfrac{15}{4}$ (C) $\dfrac{27}{5}$ (D) $\dfrac{5}{1}$

18. A proton is bombarded on a stationary Lithium nucleus. As a result of collision two α-particles are produced. The direction of motion of the α-particles with the initial direction of motion makes an angle $\cos^{-1}\dfrac{1}{4}$. If B.E/Nucleon for Li[7] and He[4] are 5.60 MeV and 7.06 MeV respectively, then :-
(A) Kinetic energy of striking proton is 17.28 MeV.
(B) Kinetic energy of striking proton is 8.64 MeV.
(C) Kinetic energy of striking proton is 4.32 MeV.
(D) Kinetic energy of striking proton is 2.16 MeV.

19. A thin plano-convex glass lens (μ = 1.5) has its plane surface reflecting and R is the radius of curvature of curved part, then which of the following ray diagram is true for an object placed at O ?
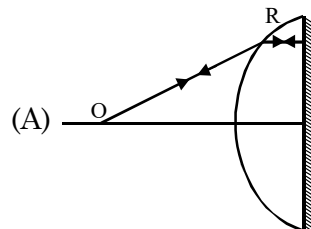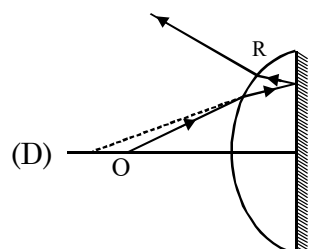

(A)
object is placed at distance 2R from lens

(B)
object is placed at distance 2R from lens
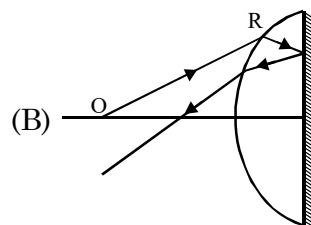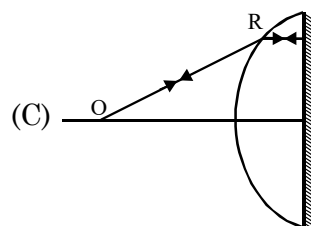
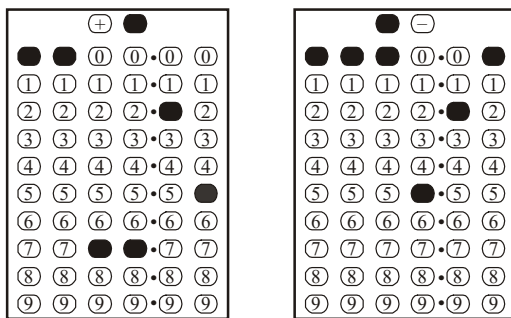
(C)
object is placed at distance 3R from lens

(D)
object is placed at distance 2R from lens

20. A voltmeter with resistance 500 Ω is used to measure the emf of a cell of internal resistance 4 Ω. The percentage error in the reading of the voltmeter will be :-
(A) 0.2%   (B) 0.8%   (C) 1.4%   (D) 2.2%

SECTION-II : (Maximum Marks: 20)

- This section contains **TEN** questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, −0.33, −.30, 30.27, −127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
 **For Example :** If answer is −77.25, 5.2 then fill the bubbles as follows.

- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases

1. A compass needle is free to rotate in a horizontal plane. It's magnetic moment is $60 Am^2$. When it is pointing geographical north, it experiences a torque of 1.2×10^{-3} Nm due to earth's magnetic field. If earth's magnetic field in horizontal direction is 40×10^{-6} T, the declination (in degree) at that place is ?

2. Damped harmonic oscillator consists of a block (m = 2 kg), a spring (k = $8\pi^2$ N/m), and a damping force (F = −bv). Initially, it oscillates with an amplitude of 25 cm. Because of the damping, the amplitude falls to three-fourths of this initial value at the completion of four oscillations. What is the value of b (in kg/s)? (Assume small damping and take : $\ell n\left(\dfrac{3}{4}\right) = -0.28$).

3. An optical fiber has index of refraction n = 1.40 and diameter d = 100 μm. It is surrounded by air. Light is sent into the fiber along the axis as shown in figure. Find smallest outside radius R (in μm) permitted for a bend in the fiber for no light to escape is.
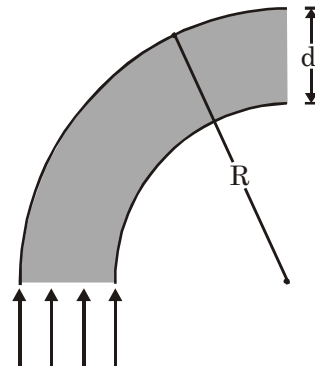

4. At a particular instant a source of sound of frequency 100 Hz is at (2m, 1m) and an observer is at (5m, 5m). The velocity of source and observer are $15\left(2\hat{i} + \hat{j}\right)$ m/s and $5\hat{i} + 15\hat{j}$ m/s respectively at this instant. The velocity of sound in air is 330 m/s. The frequency (in Hz) of the sound received by the observer is found to be

5. A plane wave is described by the equation
$$y = 3\cos\left(\frac{x}{4} - 10t - \frac{\pi}{2}\right) m.$$
The maximum velocity (in m/s) of the particles of the medium due to this wave is

6. In a particular set up, interference is observed on an screen as shown. Wavelength of light emitted by source is 4000 Å. Out of two coherent sources, one is obtained by reflection with a plane mirror of length 2m. The number of points on the screen where intensity is minimum, is :
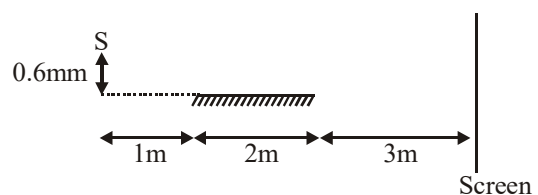
7. For the given logic gate circuit, to get output as 1 at R, find the input of X, if input value of Y is zero.
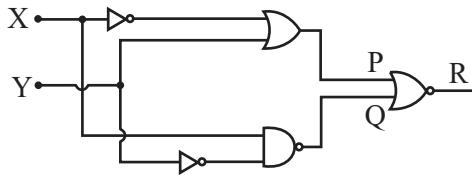
8. A block of mass m is connected to three springs as shown in the figure. The block is displaced down slightly and left free, it starts oscillating. Find the time period (in sec) of oscillations (neglecting gravity). $(m = \pi^2 kg; \pi^2 = 10 ; \theta = 60°; k_1 = 4 N/m; k_2 = 23 N/m)$
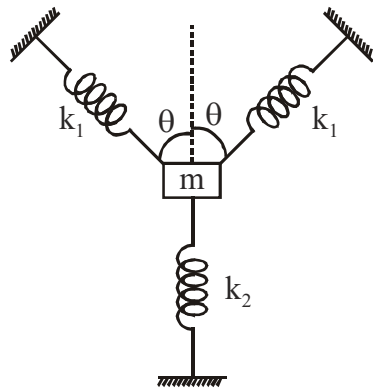
9. A piece of $-10 \, °C$ ice is heated to $-1 \, °C$ using a certain quantity of energy. Then another 19 times as much energy is necessary to finally convert entire ice to water at 0°C. Using that the specific heat of ice is half of the specific heat of water $[s_W = 4.2 \, kJ/(kg \, °C)]$, determine the heat of fusion of ice (in kJ/kg) from the above measurement data.

10. Find the charge (in µC) on the capacitor C in the figure shown. Internal resistance of a source is to be neglected. (Take : $\mathscr{E} = 9 \, V, C = 2 µF$)
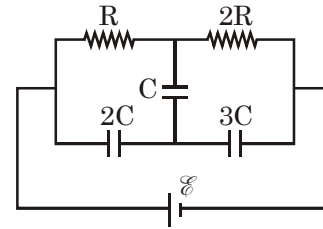
PART 2 - CHEMISTRY

SECTION–I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in <u>one of the following categories</u> :
  Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0 If none of the bubbles is darkened.
 *Negative Marks* : –1 In all other cases

1. The circumference of the fourth orbit of Li^{+2} ion is x m. The de-Broglie wavelength of electron revolving in this orbit will be

(A) $\dfrac{x}{4}$ m

(B) $4x$ m

(C) $\dfrac{x}{16}$ m

(D) $16x$ m

2. The empirical formula of a compound is CH_2O. If 0.0833 moles of the compound contains 1.0 g of hydrogen, then its molecular formula should be

(A) $C_6H_{12}O_6$

(B) $C_5H_{10}O_5$

(C) $C_4H_8O_4$

(D) $C_3H_6O_3$

3. The van der Waals equation for $(1/3)^{rd}$ mole of a gas is

(A) $\left(P+\dfrac{a}{V^2}\right)(V\text{-}b)=RT$

(B) $\left(P+\dfrac{a}{9V^2}\right)\left(V-\dfrac{b}{3}\right)=\dfrac{RT}{3}$

(C) $\left(P+\dfrac{9a}{V^2}\right)\left(\dfrac{V-b}{3}\right)=\left(\dfrac{RT}{3}\right)$

(D) $\left(P+\dfrac{a}{9V^2}\right)\left(\dfrac{V-b}{3}\right)=3RT$

4. The following reaction is at equilibrium at 298 K

$2SO_2$(g, 0.00001 bar) + O_2 (g, 0.01 bar) $\rightleftharpoons$ $2SO_3$(g, 0.01 bar).

ΔG^0 for the reaction is

(A) -45.65 kJ

(B) –28.53 kJ

(C) –22.82 kJ

(D) –57.0.6 kJ

5. What is the solubility product of a saturated solution of Ag_2CrO_4 in water at 298 K if the EMF of the cell: Ag | Ag^+ (satd. Ag_2CrO_4) || Ag^+ (0.1 M) | Ag is 0.162 V at 298 K?
[2.303RT/F = 0.06, log 2 = 0.3]

(A) 2.0×10^{-4}

(B) 3.2×10^{-11}

(C) 8.0×10^{-12}

(D) 4.0×10^{-12}

6. Pure water boils at 373 K and nitric acid at 359 K. The azeotropic mixture of water and nitric acid boils at 393.5 K. On distillation of the azeotropic mixture.

(A) pure nitric acid will distil over first.

(B) pure water will distil over first.

(C) one of them will distil over with small amount of the other.

(D) both of them will distil over in the same composition as they are in the mixture.

7. On adding $AgNO_3$ solution into KI solution, a negatively charged colloidal sol is obtained in which of following cases :

(A) 100 ml of 0.1 M $AgNO_3$ + 100 ml of 0.1 M KI

(B) 100 ml of 0.1 M $AgNO_3$ + 50 ml of 0.2 M KI

(C) 100 ml of 0.1 M $AgNO_3$ + 50 ml of 0.1 M KI

(D) 100 ml of 0.1 M $AgNO_3$ + 100 ml of 0.15 M KI

8. The dominant species obtained when

is dissolved in H_2O at pH=2, pH = 7 and at pH =12 respectively, is

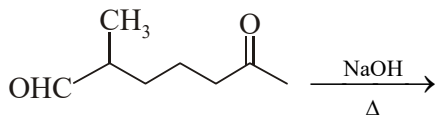(A)

(B)

(C)

(D)
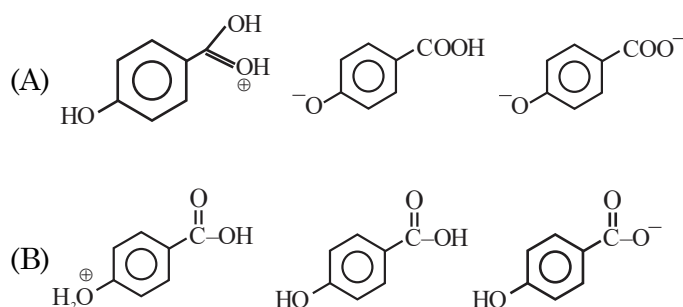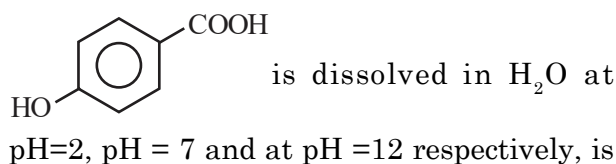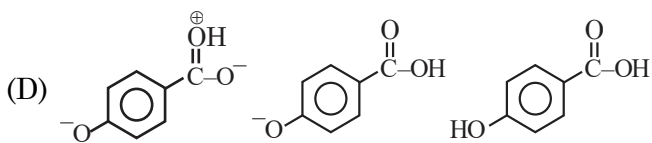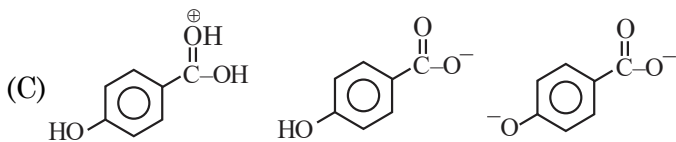
9. What is the relation between given compounds.
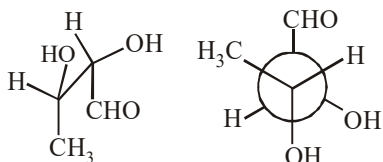
(A) Enantiomers   (B) Diastereomers
(C) Conformers   (D) Identical

**10.** The major product obtained in the following reaction is :

(A)

(B)

(C)

(D)

11. The correctly match option is

(Polymer)	(Manufacture of)
(P) PVC	(1) Cups and laminated sheets
(Q) Bakelite	(2) Handbags
(R) Polystyrene	(3) Handles of utensils
(S) Urea-formaldehyde resin	(4) Television Cabinets

(A) P→2, R→3   (B) Q → 4 , S → 1
(C) P→2 , Q→3   (D) R→4, S→2

12. An organic compound A (Molecular formula $C_6H_{12}O$) does not change the colour of acidic dichromate solution Compound A on treatment with H_2SO_4 produces alkene, which on oxidative ozonolysis gives a molecule ($C_6H_{10}O_3$) which gives positive iodoform test. Find out the structure of 'A'.
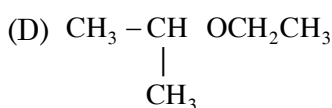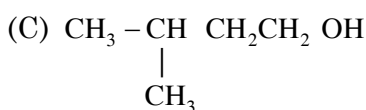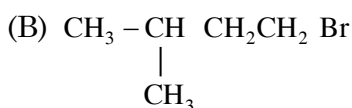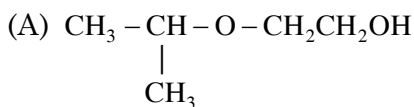
(A)

(B)

(C)

(D)

13.
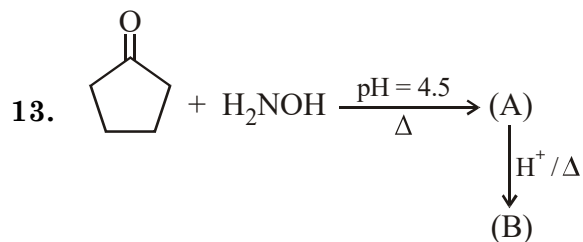
Compound 'B' is :

(A)

(B)

(C)

(D)

14. What is final product (IV) in the sequence of

$$CH_3CH-OH \xrightarrow{PBr_5} I \xrightarrow{Mg/ether} II$$
$$| $$
$$CH_3$$

$$\xrightarrow{\substack{CH_2-CH_2 \\ \diagdown \diagup \\ O}} III \xrightarrow{H_2O} IV$$

(A) $CH_3-CH-O-CH_2CH_2OH$
$\qquad\quad |$
$\qquad\quad CH_3$

(B) $CH_3-CH\ CH_2CH_2\ Br$
$\qquad\quad |$
$\qquad\quad CH_3$

(C) $CH_3-CH\ CH_2CH_2\ OH$
$\qquad\quad |$
$\qquad\quad CH_3$

(D) $CH_3-CH\ OCH_2CH_3$
$\qquad\quad |$
$\qquad\quad CH_3$
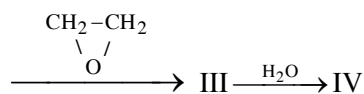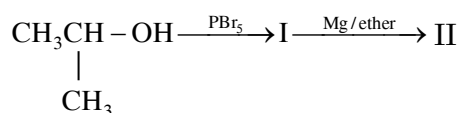
15. For an atom or ion having single electron, compare the energies of the following orbitals.

S_1 = A spherically symmetrical orbital having two spherical nodes.

S_2 = An orbital which is double dumb-bell and has no radial node.

S_3 = An orbital with orbital angular momentum zero and three radial nodes.

S_4 = an orbital having one angular node and one radial node.

(A) $S_1 = S_2 = S_3 = S_4$ (B) $S_1 = S_2 = S_4 < S_3$

(C) $S_1 > S_2 > S_3 > S_4$ (D) $S_1 < S_4 < S_3 < S_2$

16. The 1st, 2nd and the 3rd ionization enthalpies I_1, I_2 and I_3, of four atoms with atomic numbers n, n + 1, n + 2 and n + 3, where n < 10, are tabulated below. What is the value of n?

Atomic Number	Ionization Enthalpy (kJ/mol)		
	I_1	I_2	I_3
n	1579	3374	6043
n+1	2075	3952	6125
n+2	493	4562	6907
n+3	739	1451	7731

(A) 6   (B) 7

(C) 8   (D) 9

17. Which of the following statement is **CORRECT** ?

(A) Li is harder than the other alkali metals

(B) In Solvay process NH_3 is recovered when the solution containing NH_4Cl is treated with H_2O

(C) Na_2CO_3 is pearl ash

(D) Beryllium and aluminium ions do not have strong tendency to form complexes like BeF_4^{-2}, AlF_6^{-3}

18. Which of the following is **INCORRECT** :-

(A) ICl_2^- → Trigonal bipyramidal electron geometry

(B) NH_3 → Tetrahedral electron geometry

(C) SF_4 → Tetrahedral electron geometry

(D) $PBr_{5(g)}$ → Trigonal bipyramidal electron geometry

19. Which of the following is incorrect for f-block elements

(A) For lanthanoids +3 is the most common oxidation state.

(B) Lanthanoids have less tendency towards complex formation

(C) Basic character of oxides of lanthanoids decreases on increasing atomic number.

(D) Neptunium does not exhibit +7 oxidation state.

20. Which of the following method is used for the removal of only temporary hardness:-

(A) Treatment with washing soda

(B) Clark's method

(C) Calgon's method

(D) Ion-exchange method

1. At 200°C, PCl_5 dissociates as
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ .It was found that the equilibrium vapours are 62 times as heavy as hydrogen. The percentage dissociation of PCl_5 at 200°C is.
[Atomic mass : P = 31, Cl = 35.5]

2. A student was given 0.01 mole of a weak monoprotic organic acid and told to determine the K_a of the acid. He prepared 100 ml of an aqueous solution containing the sample. The volume of 50 ml of this solution was then titrated with NaOH to the equivalence point. The titrated solution was then mixed with the other 50 ml of the solution of same acid and the pH was determined. A value of 4.80 was obtained for the mixed solution. What is the value of pK_a for the acid?

3. A given sample of milk turns sour at room temperature (27°C) in 16 hours. In a refrigerator at 7°C, milk can be stored three times as long before it sours. How long (in hours) it takes milk to sour at 57°C ?
[Given : log 3 = 0.5, $10^{(7/11)} = 10^{0.64} = 4$]

4. Identify total number of 'β'-elimination reactions

(i) $\xrightarrow[KOH/\Delta]{Alco.}$

(ii) $\xrightarrow[\Delta]{Zn. dust}$

(iii) $\xrightarrow[Acetone/\Delta]{NaI}$

(iv) $\xrightarrow[\Delta]{Al_2O_3}$

(v) $\xrightarrow[\Delta]{NaNH_2}$

(vi) $\xrightarrow[KOH]{Aqueous}$

(vii) $\xrightarrow[Acetone]{NaI}$

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(viii)

$$\underset{OH}{\overset{\ }{\text{CH}_3\text{CHCH}_2\text{CH}_3}} \xrightarrow[\text{H}_3\text{PO}_4/\Delta]{\text{Conc.}}$$

(ix)

$$\xrightarrow[\text{ether}]{\text{Mg/Dry}}$$
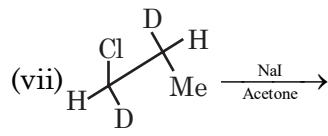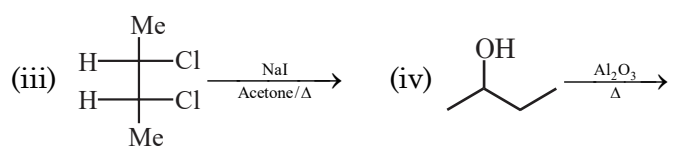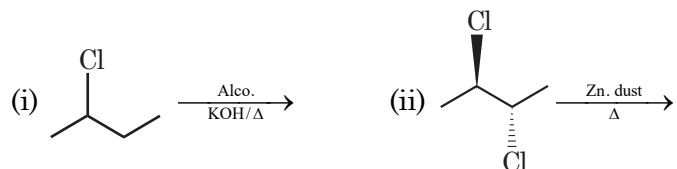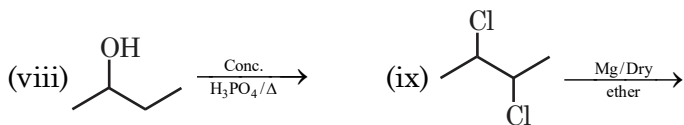
5. Number of mole of CO_2 evolved in following

reaction :

$$\xrightarrow[\text{(ii) H}_3\text{O}^+,\Delta]{\text{(i) O}_3/\text{Zn}}$$
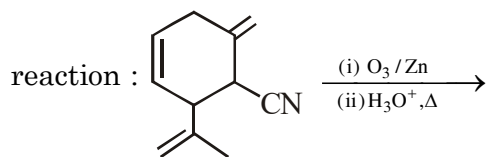
6. A tetrapeptide has —COOH group on alanine. The produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with —NH_2 group attached to a chiral centre is

7. When chromite ore is fused in strong alkali in presence of air, the number of equivalent bond lengths in anionic part of Cr-containing product is x.

Find the value of $\dfrac{1}{x}$.

8 Total number of geometrical isomer formed by complex compound $[\text{Co(gly)}_2\text{BrI}]^{\ominus}$

9 The change in oxidation state of Pb when galena is roasted for the lead extraction from it's low grade ore.

10. Find the number of nitrate which gives NO_2 gas on heating from the following : Nitrogen dioxide is released on heating: NH_4NO_3, KNO_3, $NaNO_2$, $Pb(NO_3)_2$, $AgNO_3$

PART 3 - MATHEMATICS

SECTION–I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in <u>one of the following categories</u> :
  Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0 If none of the bubbles is darkened.
  Negative Marks : −1 In all other cases

1. The negation of the proposition

   "If a quadrilateral is a square, then it is a rhombus" is

   (A) If a quadrilateral is a square, then it is a rhombus.

   (B) If a quadrilateral is a square, then it is not a rhombus.

   (C) A quadrilateral is a square and it is not a rhombus.

   (D) A quadrilateral is not a square and it is a rhombus.

2. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class in the same subject is 72, then what is the average of the girls?

   (A) 73   (B) 65

   (C) 68   (D) 74

3. If $iz^3 + z^2 - z + i = 0$, then $|z|$ is equal to

   (A) 0   (B) 1

   (C) 2   (D) 3

4. Let n be a fixed positive integer. Define a relation R in the set Z of integers by aRb if and only if a − b is divided by n. The relation R is

   (A) reflexive   (B) symmetric

   (C) transitive   (D) an equivalence relation

5. In a ΔABC following usual notation, if $r_1 = 2r_2 = 3r_3$ then a : b : c is equal to

   (A) 5 : 4 : 3   (B) 4 : 5 : 3

   (C) 3 : 4 : 5   (D) 7 : 6 : 5

6. The locus of the midpoint of the intercept of the line $x \cos \alpha + y \sin \alpha = p$ between the coordinate axes is

   (A) $x^{-2} + y^{-2} = 4p^{-2}$ (B) $x^{-2} + y^{-2} = p^{-2}$

   (C) $x^2 + y^2 = 4p^{-2}$ (D) $x^2 + y^2 = p^2$

7. Locus of midpoint of chords of the circle $x^2 + y^2 = 25$, which are tangents to the circle $x^2 + y^2 - 20x - 20y + 175 = 0$ will be :

   (A) $(10x + 10y + x^2 + y^2)^2 = (x^2 + y^2)$

   (B) $(10x + 10y - x^2 + y^2)^2 = 100 (x^2 + y^2)$

   (C) $(10x + 10y - x^2 - y^2) = 25 (x^2 + y^2)$

   (D) $(10x + 10y - x^2 - y^2)^2 = 25 (x^2 + y^2)$

8. Abscissa of two points P and Q on parabola $y^2 = 8x$ are root of equations $x^2 - 17x + 11 = 0$. Tangent at P and Q meet at point T. Distance of T from focus of the parabola is equal to

   (A) 5   (B) 6

   (C) 7   (D) 8

9. If line $x - 2y = 12$ is tangent to ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ at point $\left(3, \dfrac{-9}{2}\right)$, then length of the latus rectum of ellipse is

   (A) $8\sqrt{3}$ (B) $12\sqrt{2}$

   (C) 5   (D) 9

10. $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$ then

(A) $\alpha = 1, \beta = -1$ (B) $\alpha = 1, \beta = 0$

(C) $\alpha = -1, \beta = -1$ (D) $\alpha = \pm 1, \beta = 1$

11. If the planes x = cy + bz, y =az + cx, z = bx + ay pass through a line, then $a^2 + b^2 + c^2 + 2abc$ is

(A) 0   (B) 1

(C) 2   (D) 3

12. Let α and β be the roots of equation $x^2 - (a-2)x - a - 1 = 0$, then $\alpha^2 + \beta^2$ assumes the least value if

(A) a = 0   (B) a = 1

(C) a = − 1   (D) a = 2

13. Let $a_1, a_2, a_3, ...$ be in A.P. and a_p, a_q, a_r be in G.P. then $a_q : a_p$ is equal to

(A) $\dfrac{r-p}{q-p}$ (B) $\dfrac{q-p}{r-q}$

(C) $\dfrac{r-q}{q-p}$ (D) 1

14. In how many ways can three persons each throwing, a single dice once, make a sum of 15?

(A) 10   (B) 15

(C) 5   (D) 25

15. If the $(r + 1)^{th}$ term in the expansion of

$\left(\sqrt[3]{\dfrac{a}{\sqrt{b}}} + \sqrt{\dfrac{b}{\sqrt[3]{a}}} \right)^{21}$ has the same power of a and

b, then the value of r is

(A) 9   (B) 10

(C) 8   (D) 6

16. Two integers x and y are chosen with replacement out of the set {0, 1, 2, 3,....., 10}. Then the probability that $|x - y| > 5$ is

(A) $\dfrac{81}{121}$ (B) $\dfrac{30}{121}$

(C) $\dfrac{25}{121}$ (D) $\dfrac{20}{121}$

17. If $\tan\theta = \dfrac{x\sin\phi}{1 - x\cos\phi}$ and $\tan\phi = \dfrac{y\sin\theta}{1 - y\cos\theta}$

then $\dfrac{x}{y} =$

(A) $\dfrac{\sin\phi}{\sin\theta}$

(B) $\dfrac{\sin\theta}{\sin\phi}$

(C) $\dfrac{\sin\phi}{1 - \cos\theta}$

(D) $\dfrac{\sin\theta}{1 - \cos\phi}$

18. If A and B be positive acute angle satisfying $3\sin^2 A + 2\sin^2 B = 1$, $3\sin 2A - 2\sin 2B = 0$, then

(A) $B = \dfrac{\pi}{4} - \dfrac{A}{2}$

(B) $A = \dfrac{\pi}{4} - 2B$

(C) $B = \dfrac{\pi}{2} - \dfrac{A}{4}$

(D) $A = \dfrac{\pi}{4} - \dfrac{B}{2}$

19. $\displaystyle\int \dfrac{\sin 2x}{\sin 5x \sin 3x} dx$ is equal to (where 'C' is constant of integration)

(A) $ln \sin 3x - ln \sin 5x + C$

(B) $\dfrac{1}{3} ln \sin 3x + \dfrac{1}{5} ln \sin 5x + C$

(C) $\dfrac{1}{3} ln \sin 3x - \dfrac{1}{5} ln \sin 5x + C$

(D) $3 ln \sin 3x - 5 ln \sin 5x + C$

20. $(1 + x^2)\dfrac{dy}{dx} = x(1 - y)$, $y(0) = \dfrac{4}{3}$ then the

value of $y\left(\sqrt{8}\right) + \dfrac{8}{9}$ is equal to

(A) 4   (B) 2

(C) 3   (D) 5

- This section contains **TEN** questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.

- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases

1. $g(x) = \dfrac{1}{f^{-1}(x)}$ given the following data

x	0	1	2	3	4
f(x)	–2	–1	2	4	6
f'(x)	1/2	2/3	1	4/3	5/3

then the absolute value of g ' (4) is equal to

2. $\displaystyle\lim_{x\to\infty} \dfrac{2x^{\frac{1}{2}} + 3x^{\frac{1}{3}} + 4x^{\frac{1}{4}} + ... + nx^{\frac{1}{n}}}{(3x-4)^{\frac{1}{2}} + (3x-4)^{\frac{1}{3}} + ... + (3x-4)^{\frac{1}{n}}}$

$(n \in N, n \geq 2)$ is equal to

3. If f ' (c) exists and is non-zero, then the value

of $\displaystyle\lim_{h\to 0} \dfrac{f(c+h) + f(c-h) - 2f(c)}{h}$ is equal to

4. The sum of coordinate of point on curve $x^2 = 4y$ which is at minimum distance from the line $y = x - 4$ is equal to

5. Let 'f' be a differentiable function $\forall \, x \in R$ where $f(1) = 2$ & $f(3) = 7$ & $f'(x) \geq 2 \, \forall \, x \in R$ then minimum integral value of $f(2)$ is

6. If $\displaystyle\int_{\frac{1}{4}}^{\frac{3}{4}} \dfrac{\frac{\pi}{2} + \cos^{-1} x}{2\sin^{-1} x + 3\cos^{-1} x + \cos^{-1}(1-x)} dx = k$, then

k is equal to

7. The area bounded by the curve $\sqrt{x} + \sqrt{y} = 1$

and $x + y = 1$ is equal to

8. The value of

$$\cos^{-1}\left[\cot\left\{\sin^{-1}\left(\sqrt{\dfrac{2-\sqrt{3}}{4}}\right) + \cos^{-1}\left(\dfrac{\sqrt{12}}{4}\right) + \sec^{-1}\left(\sqrt{2}\right)\right\}\right]$$

is equal to

9. If A is square matrix of order 3 such that

$| A | = 2$ then $| (adj. A^{-1})^{-1} |$ is equal to

10. If the system of equations

$\alpha x + (\alpha + 1)y + (\alpha + 2)z = 0$

$(\alpha + 1)x + (\alpha + 2)y + \alpha z = 0$

$(\alpha + 2)x + \alpha y + (\alpha + 1)z = 0$

have non-zero solutions, then the number of possible value of α are