


IIT
KALRASHUKLA
A Class Apart

CLASS – 12th (ENGINEERING)

Time : 90 minutes

Maximum Marks : 180

-: Important Instructions :-

- (i) Use only Black Ball Point pen.
- (ii) This test booklet contains 4 Sections of question paper consisting of
 - SECTION - I → PHYSICS (10 Questions)
 - SECTION - II → CHEMISTRY (10 Questions)
 - SECTION - III → MATHS (10 Questions)
 - SECTION - IV → MENTAL ABILITY & REASONING (15 Questions)
- (iii) Each question is allotted **4 marks for correct response**.
- (iv) **1 mark will be deducted** for marking incorrect or multiple responses.
- (v) No deduction will be made from total marks for unattempted questions.
- (vi) For each question, there is **only 1 correct** response.

Name of Student (in Capital Letter) : _____

Candidate Signature : _____

Invigilator Signature : _____

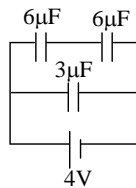
SECTION - I

PHYSICS

1. Charges $2Q$ and $-Q$ are placed as shown. The point at which electric field intensity is zero will be
- (A) somewhere between $-Q$ and $2Q$
 (B) somewhere on the left of $-Q$
 (C) somewhere on the right of $2Q$
 (D) somewhere on the right bisector of line joining $-Q$ and $2Q$

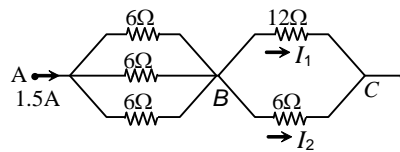


2. The three capacitors in figure, store a total energy of



- (A) $12 \mu\text{J}$ (B) $36 \mu\text{J}$
 (C) $48 \mu\text{J}$ (D) $80 \mu\text{J}$

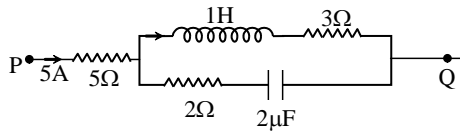
3. In the network shown,



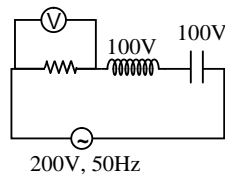
- (A) $V_{AB} = +3.0 \text{ V}$ (B) $V_{CB} = +6.0 \text{ V}$
 (C) $I_1 = 1.5 \text{ A}$ (D) $I_2 = 0.5 \text{ A}$
4. A charged particle enters a region where a uniform electric field E and a uniform magnetic field B exist. If E and B are perpendicular to each other and also perpendicular to the velocity u of the particle, then the particle will move undeviated if u equals
- (A) B/E (B) E/B (C) EB (D) E^2/B^2

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5. The angle of dip at a place on the earth gives
 (A) the horizontal component of the earth's magnetic field
 (B) the location of the geographic meridian
 (C) the vertical component of the earth's field
 (D) the direction of the earth's magnetic field
6. In the given circuit, the potential difference between point P and Q in steady state is



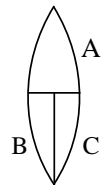
- (A) 40 V (B) 21 V (C) 18 V (D) 18 V
7. In the circuit of figure, what will be the reading of the voltmeter?



- (A) 300V (B) 900 V (C) 200V (D) 400 V

8. A thin, symmetric double-convex lens of power P is cut into three parts A, B and C as shown. The power of

- (A) A is P/2 (B) A is 2P
 (C) B is P/2 (D) B is P/4



9. In a compound microscope, the intermediate image is
 (A) virtual, erect and magnified (B) real, erect and magnified
 (C) real, inverted and magnified (D) virtual, erect and reduced

10. The X-rays coming from an X-ray tube will be
 (A) monochromatic
 (B) having all wavelength smaller than a certain minimum wavelength
 (C) having all wavelength greater than a certain minimum wavelength
 (D) having all wavelength between certain minimum and maximum wavelengths

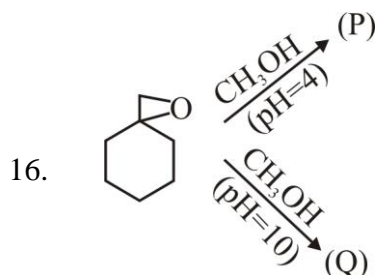
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SECTION - II**CHEMISTRY**

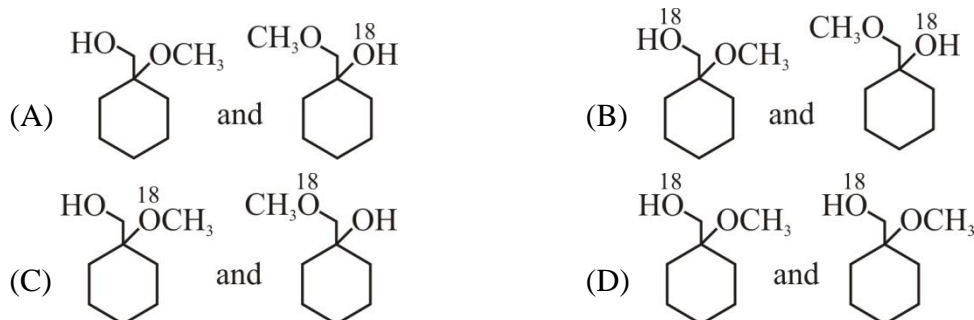
11. A certain solute upon dissolution in some solvent undergoes 45% trimerization and 40% dimerization. What is the value of $\frac{1}{i}$ for this situation :
- (A) 1 (B) 2 (C) 0.5 (D) 4
12. Zn Amalgam is prepared by electrolysis of aqueous ZnCl_2 using Hg cathode (9gm.) How much current is to be passed through ZnCl_2 solution for 1000 seconds to prepare a Zn Amalgam with 25% Zn by wt. ($\text{Zn} = 65.4$)
- (A) 5.6 amp (B) 7.2 amp (C) 8.85 amp (D) 11.2 amp
13. A reaction can take place by two paths. k_1 and k_2 are rate constants for the two paths & E_1 and E_2 are their respective activation energies. At temperature T_a : $k_1 > k_2$, $E_1 < E_2$. if temperature is raised to T_b , the rate constants change to k_1' & k_2' . Which relation is correct between k_1 , k_2 , k_1' & k_2' (considering activation energy does not change with temperature).
- (A) $\frac{k_1'}{k_1} > \frac{k_2'}{k_2}$ (B) $\frac{k_1'}{k_1} = \frac{k_2'}{k_2}$ (C) $\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$ (D) $\frac{k_1'}{k_2'} > \frac{k_1}{k_2}$
14. The pk_{a_1} , pk_{a_2} and pk_{a_3} values for the amino acid cysteine $\left(\begin{array}{c} \text{HS} - \text{CH}_2 - \text{CH} - \text{COOH} \\ | \\ \text{NH}_2 \end{array} \right)$ are respectively 1.8, 8.3, 10.8. What is isoelectric point of cysteine amino acid?
- (A) 6.3 (B) 9.55 (C) 5.05 (D) 10.1

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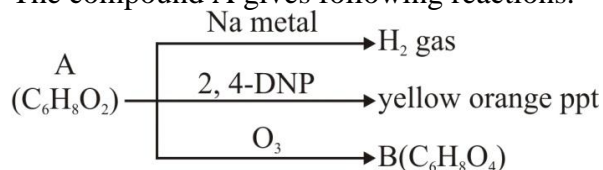
15. $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ and $[\text{Cr}(\text{NH}_3)_6](\text{NO}_2)_3$ both are paramagnetic species with 'spin only' magnetic moment of 3.93 B.M. The hybridisation of central metal ions in these species respectively are :
- (A) both sp^3d^2 (B) both d^2sp^3 (C) sp^3d^2 and d^2sp^3 (D) d^2sp^3 and sp^3d^2



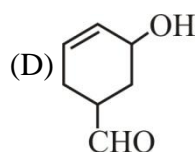
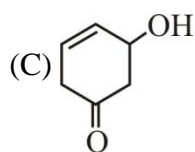
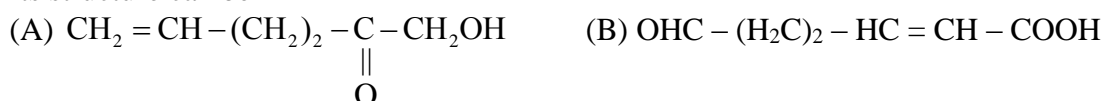
Identify product (P) and (Q) respectively?



17. The compound A gives following reactions.

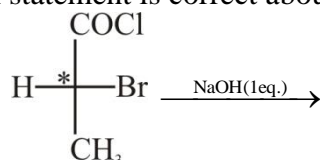


Its structure can be



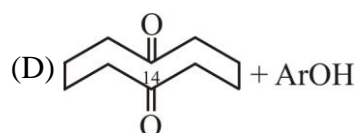
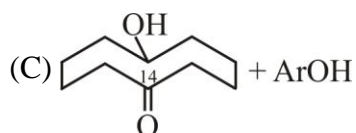
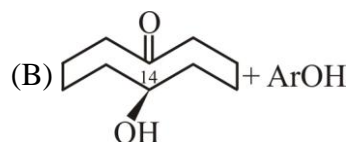
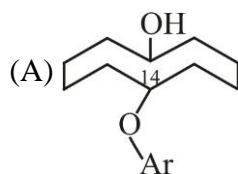
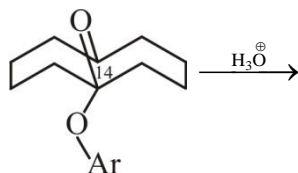
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18. Which statement is correct about the following reaction

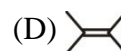
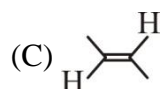
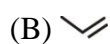
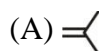


- (A) There is inversion of configuration at asymmetric C* atom
 (B) There is no change of configuration at asymmetric C* atom
 (C) There is 100% racemisation at C* atom
 (D) % inversion > % retention at C* atom

19. The product of following reaction is



20. $\text{-(CH}_2\text{-}\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}\text{-CH}_2\text{-}\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}\text{)}_n$ is a polymer having monomer units _____.



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SECTION - III**MATHS**

21. The magnitudes of mutually perpendicular forces **a**, **b** and **c** are 2, 10 and 11 respectively. Then the magnitude of its resultant is
 (A) 12 (B) 15 (C) 9 (D) 18
22. If α, β, γ be the angles which a line makes with the positive direction of co-ordinate axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$
 (A) 2 (B) 1 (C) 3 (D) 0
23. The domain of $\sin^{-1} \left[\log_3 \left(\frac{x}{3} \right) \right]$ is
 (A) [1, 9] (B) [-1, 9] (C) [-9, 1] (D) [-9, -1]
24. $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$ equals
 (A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{3}{2}$
25. The values of A and B such that the function $f(x) = \begin{cases} -2 \sin x, & x \leq -\frac{\pi}{2} \\ A \sin x + B, & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ \cos x, & x \geq \frac{\pi}{2} \end{cases}$, is continuous everywhere are
 (A) A = 0, B = 1 (B) A = 1, B = 1 (C) A = -1, B = 1 (D) A = -1, B = 0

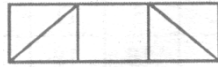
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26. The differential equation satisfied by the function $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots \infty}}}$, is
- (A) $(2y - 1) \frac{dy}{dx} - \sin x = 0$ (B) $(2y - 1) \cos x + \frac{dy}{dx} = 0$
(C) $(2y - 1) \cos x - \frac{dy}{dx} = 0$ (D) $(2y - 1) \frac{dy}{dx} = \cos x$
27. $\int (1 + 2x + 3x^2 + 4x^3 + \dots) dx =$
- (A) $(1 + x)^{-1} + c$ (B) $(1 - x)^{-1} + c$ (C) $(2 + x)^{-1} + c$ (D) $(2 - x)^{-1} + c$
28. $\int_0^{\pi/2} \frac{x + \sin x}{1 + \cos x} dx =$
- (A) $-\log 2$ (B) $\log 2$ (C) $\frac{\pi}{2}$ (D) 0
29. The solution of the differential equation $x^2 \frac{dy}{dx} = x^2 + xy + y^2$ is
- (A) $\tan^{-1}\left(\frac{y}{x}\right) = \log x + c$ (B) $\tan^{-1}\left(\frac{y}{x}\right) = -\log x + c$
(C) $\sin^{-1}\left(\frac{y}{x}\right) = \log x + c$ (D) $\tan^{-1}\left(\frac{x}{y}\right) = \log x + c$
30. If A and B are two events of a random experiment $P(A) = 0.25$, $P(B) = 0.5$ and $P(A \cap B) = 0.15$, then $P(A \cap \bar{B}) =$
- (A) 0.1 (B) 0.35 (C) 0.15 (D) 0.6

Space for Rough Work

SECTION -IV**MENTAL ABILITY & REASONING**

31. How many quadrilaterals are there in the following figure ?



- (A) 11 (B) 8 (C) 2 (D) 4
32. Find the wrong term -
9, 11, 15, 23, 39, 70, 135
(A) 23 (B) 39 (C) 70 (D) 135
33. A watch reads 4 : 30. If the minute - hand points to East, in which direction does the hour-hand point ?
(A) North-East (B) South-East (C) North-West (D) North
34. The time in the clock is 4 : 46, what is the mirror image ?
(A) 7 : 24 (B) 7 : 14 (C) 7 : 14 (D) 7 : 24
35. Neelam, who is Rohit's daughter, says to Indu, "Your mother Reeta is the younger sister of my father, who is the third child of Sohanji." How is Sohanji related to Indu ?
(A) Maternal-uncle (B) Grandfather
(C) Father (D) Father-in-law

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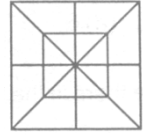
36. If the seventh day of month is three days earlier than Friday, what day will it be one the nineteenth day of the month ?
(A) Sunday (B) Monday (C) Wednesday (D) Friday
37. Sum of the Proper divisors of 100.
(A) 217 (B) 216 (C) 116 (D) 117
38. Sanjay went 70 metres in the East before turning to his right. He went 10 metres before turning to his right again and went 10 metres from this point. From here he went 90 metres to the North. How far was he from the starting point ?
(A) 80 metres (B) 100 metres (C) 140 metres (D) 260 metres
39. If **RAT** = 42 and **CAT** = 57, then **LATE** = ?
(A) 60 (B) 70 (C) 64 (D) 74
-

Space for Rough Work

Direction 40: Which sequence of letter when placed at the blanks one after the other will complete the given letter series ?

40. abc_d_bc_d_db_cda
(A) bacdc (B) cdabc (C) dacab (D) dccbd

41. Count the number of triangles and squares in the following figure ?
(A) 28 triangles, 10 squares
(B) 28 triangles, 8 squares
(C) 32 triangles, 10 squares
(D) 32 triangles, 8 squares.



Direction 42 : Six friends are sitting around a circular table at equal distances from each other. Ramola is sitting two places right of Komolika who is exactly opposite to Anu. Anu is sitting on the immediate left of Pallavi, who is exactly opposite to Mandira, natasha is also sitting at the table.

42. Which of the following statements is not correct ?
(A) Natasha and Ramola are exactly apposite to each other.
(B) Mandira and Natasha are at equal distance from Komolika.
(C) Angle subtended by Manidra and Natasha is same at the angle subtended by Ramola and Pallavi at the centre of the table.
(D) Natasha is on the immediate left of Pallavi.

Space for Rough Work

