

# JEE-ADVANCE: TEST-14

## TEST SERIES

### PAPER-II

Time : 3 hrs.

M.M.: 180

**TEST CODE - A**

**TOPIC COVERED :**

**PHYSICS:** Complete XI and XII Syllabus

**CHEMISTRY:** Complete XI and XII Syllabus

**MATHEMATICS:** Complete XI and XII Syllabus

**ATTENTION:** Kindly ask for the Roll No. from the invigilator to fill in OMR SHEET. Mark the Roll No. & Test code on the answer sheet properly. (No other sheet will be issued)

**GENERAL INSTRUCTIONS :**

1. The Test Paper consists of **60** questions
2. There are **Three Subjects (Physics, Chemistry & Mathematics)** in the question paper.
3. **This paper is divided into 3 parts: Physics Section (I), (II) and (III); Chemistry Section (I), (II) and (III) & Mathematics Section (I), (II) and (III).**
  - **Multiple correct answer type questions : Physics Section (II) (1 to 8) Chemistry Section II (21 to 28) and Mathematics Section II (41 to 48), 3 marks for each correct answer and -1 mark for incorrect answer.**
  - **Linked Comprehension type questions: Physics Section-II (9 to 16) (4 comprehensions, with 2 questions); Chemistry Section-II (29 to 36) (4 comprehension, with 2 questions); Mathematics Section- II (49 to 56) (3 comprehension, with 3 and 2 questions) 3 marks for each correct answer and -1 mark for incorrect answer.**
  - **Match the following: Physics Section-III (17 to 20); Chemistry Section-III (37 to 40) and Mathematics Section- IV (57 to 60) 3 marks for each correct answer and -1 mark for incorrect answer.**

Name of the Student : \_\_\_\_\_

Section : \_\_\_\_\_

Centre : \_\_\_\_\_

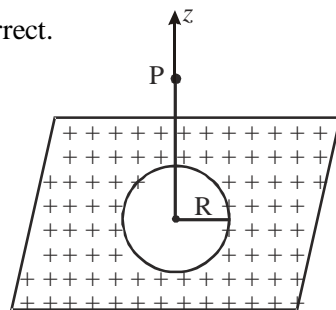
Invigilator's Signature : \_\_\_\_\_

**SECTION- I: MULTIPLE CORRECT ANSWERS TYPE**

This section contains 8 multiple choice questions numbered 1 to 8. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

1. A large flat nonconducting surface has a uniform charge density  $s$ . A small circular hole of radius 'R' has cut in the middle of the surface. Ignore fringing effect, which of the options are correct.

- (a) Electric field at P is  $\frac{\sigma z}{2\epsilon_0\sqrt{z^2 + R^2}}$   
 (b) electric field at P is  $\frac{\sigma z^2}{2\epsilon_0(z^2 + R^2)}$   
 (c) electric potential at the point P is infinite  
 (d) none of these



2. A wave is represented by the equation :

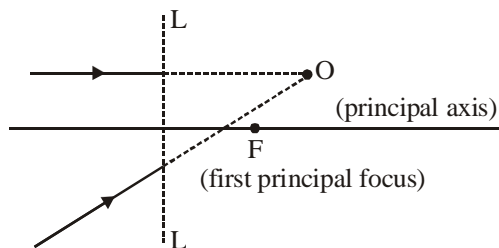
$$y = (1 \text{ mm}) \sin [(50\text{s}^{-1}) t + (2.0 \text{ m}^{-1})x] + (1 \text{ mm}) \cos [(50 \text{ s}^{-1})t - (2.0 \text{ m}^{-1})x]$$

- (a) Energy transfer occurs along the positive  $x$ -axis.  
 (b) A node is formed at  $x = \frac{3\pi}{8}$  m.  
 (c) The amplitude of the oscillation at the antinode is 2 mm.  
 (d) none of these
3. Which of the following products, in a hydrogen atom, are independent of the principal quantum number  $n$  ? The symbols have their usual meanings

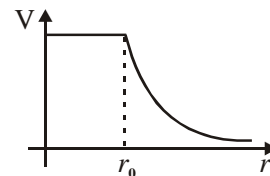
- (a)  $\omega^2 n$                       (b)  $\frac{E}{v^2}$                       (c)  $v^2 r$                       (d)  $\frac{E}{r}$

4. Consider the rays shown in the diagram as paraxial. The image of the virtual point object O formed by the lens LL is

- (a) Virtual.  
 (b) Real.  
 (c) Located below the principal axis.  
 (d) Located left of the lens.



5. In a Young's double-slit experiment performed in air, let A and B be the two slits. A parallel beam of monochromatic light is incident normally onto the plane of the double slit. A thin film of thickness  $t$  and refractive index  $\mu$  is placed in front of A. Let  $\beta$  = fringe width. The central maximum will shift
- (a) towards A      (b) towards B      (c) by  $t(\mu - 1)\frac{\beta}{\lambda}$       (d) by  $\mu t\frac{\beta}{\lambda}$
6. The two vectors **A** and **B** are drawn from a common point and  $\mathbf{C} = \mathbf{A} + \mathbf{B}$ , then angle between **A** and **B** is
- (a)  $90^\circ$  if  $C^2 = A^2 + B^2$       (b) greater than  $90^\circ$  if  $C^2 < A^2 + B^2$   
(c) greater than  $90^\circ$  if  $C^2 > A^2 + B^2$       (d) less than  $90^\circ$  if  $C^2 > A^2 + B^2$
7. For spherical symmetrical charge distribution, variation of electric potential with distance from centre is given in diagram. Given that  $V = \frac{q}{4\pi\epsilon_0 r_0}$  for  $r \leq r_0$  and  $V = \frac{q}{4\pi\epsilon_0 r}$  for  $r \geq r_0$
- Then which option(s) are correct
- (a) Total charge within  $2r_0$  is  $q$   
(b) Total electrostatic energy for  $r \leq r_0$  is zero  
(c) At  $r = r_0$  electric field is discontinuous  
(d) none of these
8. A YDSE apparatus is immersed in a medium of refractive index ' $n$ ' which of the following statements is correct
- (a) the plot between fringe width and refractive index is hyperbola  
(b) the plot between rate of change of fringe width with ' $n$ ' is inverse square law  
(c) rate of increase in fringe width is not equal to rate of decrease in refractive index.  
(d) all the statements are false.



### SECTION- II: PARAGRAPH TYPE

This Section contains **4 paragraphs** each describing theory, experiment, data etc. **Eight questions** relate to four paragraphs with two questions on each paragraph. Each question of a paragraph has **only one correct answer** amount the four choice (A), (B), (C) and (D).

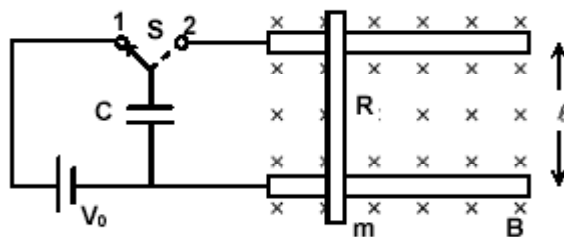
#### Paragraph for Question 9 to 11

Gravitational force is a conservative and medium independent force. Its nature is attractive. Gravitational field intensity and gravitational potential give information about gravitational field in vector and scalar form respectively. Actually gravitational field intensity is equal to negative of the potential gradient. Potential energy is defined for only conservative forces. It is also equal to the total energy in escaping condition. Gravitational potential is either negative or zero and can never be positive due to attractive nature of gravitational force.

9. A person brings a mass of 1 kg from infinity to a point A. Initially the mass was at rest but it moves with a speed of 2 m/s as it reaches A. The work done by the person on the mass is (-3J). The potential of A is  
 (a) -3 J/kg                      (b) -2 J/kg                      (c) -5 J/kg                      (d) -1 J/kg
10. The gravitational potential inside a hollow sphere (mass M, radius R) at a distance  $r$  from the centre is  
 (a) zero                      (b)  $-\frac{GM}{R}$                       (c)  $-\frac{GM}{r}$                       (d)  $-\frac{GM}{r^2}$
11. Two metallic spheres are placed at a small distance. Gravitational force of attraction is proportional to (density of both spheres are equal)  
 (a)  $r$                       (b)  $r^4$                       (c)  $r^{-2}$                       (d)  $r^{-4}$

**Paragraph for Question 12 to 14**

One end of a horizontal fixed track of negligible resistance is connected to a capacitor of capacitance  $C$  charged to voltage  $V_0$ . The inductance of the assembly is negligible. The system is placed in a homogenous, vertical magnetic field of induction  $B$  as shown in the figure.

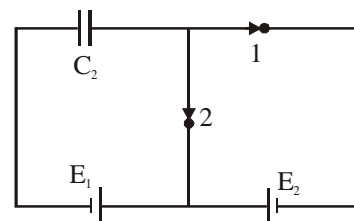


A frictionless conducting rod of mass  $m$  and negligible resistance is placed perpendicularly on to the track. The polarity of the capacitor is such that the rod is repelled from the capacitor. Now the switch is turned from 1 to 2

12. What is the maximum velocity of the rod?  
 (a)  $\frac{BlCV_0}{m + B^2l^2C}$                       (b)  $\frac{2BlCV_0}{m + B^2l^2C}$                       (c)  $\frac{BlCV_0}{2(m + B^2l^2C)}$                       (d) none of these
13. Find the minimum charge on the capacitor  
 (a)  $\frac{B^2l^2C^2V_0}{2m + B^2l^2C}$                       (b)  $\frac{B^2l^2C^2V_0}{m + B^2l^2C}$                       (c)  $\frac{2B^2l^2C^2V_0}{m + B^2l^2C}$                       (d) none of these
14. Find the maximum efficiency of this electromagnetic gun.  
 (a)  $\frac{1}{\left[ \frac{\sqrt{m}}{Bl\sqrt{C}} + \frac{Bl\sqrt{C}}{\sqrt{m}} \right]^2}$                       (b)  $\frac{1}{\left[ \frac{\sqrt{m}}{Bl\sqrt{C}} + \frac{2Bl\sqrt{C}}{\sqrt{m}} \right]^2}$   
 (c)  $\frac{1}{\left[ \frac{\sqrt{m}}{2Bl\sqrt{C}} + \frac{Bl\sqrt{C}}{\sqrt{m}} \right]^2}$                       (d) none of these

**Paragraph for Question 15 to 16**

In the circuit diagram shown, switch is shifted from position 1 to position 2.

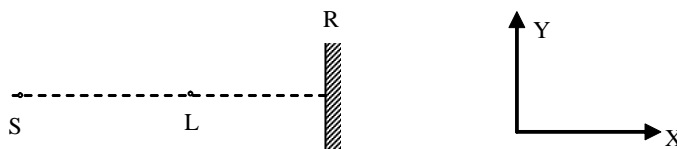


15. What is the charge drawn from battery  $E_1$ ?
- (a)  $E_1 C$                       (b)  $E_2 C$                       (c)  $E_1^2/E_2 C$                       (d) none of these
16. Heat generated in the circuit is
- (a)  $1/2 E_1^2 C$ .                      (b)  $1/2 E_2^2 C$ .                      (c)  $1/4 E_2^2 C$ .                      (d) none of these

**SECTION- III: MATCHING LIST TYPE**

This Section contains **4 multiple choice questions**. Each question has matching lists. The codes for lists have choice (A), (B), (C) and (D) out of which **ONLY ONE** may be correct.

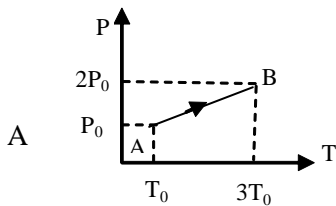
17. A source S of sonic oscillations, of frequency  $f_0 = 330$  Hz a listener L, and a reflector R are located on a line as shown in the figure below. The speed of sound in medium is,  $v = 330$  m/s. Velocities of S, L and R are with respect to the medium.



Beat frequency is detected with some instrument. Corresponding to different combination of velocities of S, L and R, in List I match them with Beat frequencies given in List II

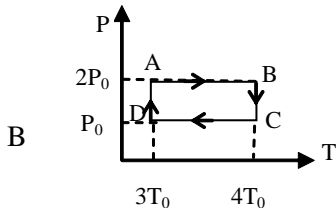
- A  $\vec{V}_S = (30 \text{ m/s})\hat{x}$ ;  $\vec{V}_L = 0$ ;  $\vec{V}_R = 0$                       (p) 55
- B  $\vec{V}_S = 0$ ;  $\vec{V}_L = 0$ ;  $\vec{V}_R = (30 \text{ m/s})\hat{x}$                       (q) 60.5
- C  $\vec{V}_S = (30 \text{ m/s})\hat{x}$ ;  $\vec{V}_L = 0$ ;  $\vec{V}_R = 0$                       (r) Zero
- D  $\vec{V}_S = (10 \text{ m/s})\hat{x}$ ;  $\vec{V}_L = (30 \text{ m/s})\hat{x}$ ;  $\vec{V}_R = (30 \text{ m/s})\hat{x}$                       (s) 2.5
- (a) A-(r), B-(p), C-(q), D-(r)                      (b) A-(q), B-(r), C-(s), D-(p)
- (c) A-(s), B-(r), C-(p), D-(q)                      (d) A-(r), B-(s), C-(p), D-(q)

18. Some graphs of thermodynamic processes are given in List I and corresponding work done (W), is given in List II. Match them.



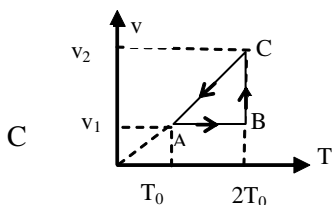
One mole, monoatomic gas

(p)  $W = 2RT_0 \ln 2$



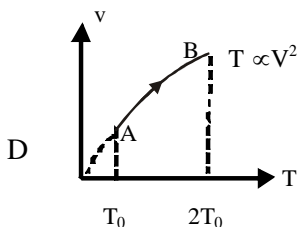
Two moles, helium gas

(q)  $W = \frac{RT_0}{2}$



Pressure at A is P<sub>0</sub>. 1 mole deal gas

(r)  $W = RT_0 \ln 2$



(s)  $W = 2RT_0 \ln 2 - RT_0$

Pressure at A is P<sub>0</sub>. One mole, monoatomic gas.

(a) A-(q), B-(p), C-(s), D-(r)

(b) A-(r), B-(p), C-(s), D-(q)

(c) A-(s), B-(p), C-(r), D-(q)

(d) A-(r), B-(s), C-(p), D-(q)

19. A Electric field

(p)  $-\int \mathbf{E} \cdot d\mathbf{l}$

B Potential inside

(q) inside conductor is zero.

C Magnetic force

(r) does't change kinetic energy

D concave mirror

(s) is always converging

(a) A-(q), B-(p), C-(p), D-(p),(r)

(b) A-(q), B-(p), (r), C-(p), D-(s)

(c) A-(s), B-(r), C-(p),(r), D-(q)

(d) A-(q), B-(p),(q); C-(r); D-(s)

20. An electron in hydrogen atom moves from  $n = 1$  to  $n = 2$ . Match the following

**Column-I**

- A. Angular momentum  
 B. Kinetic energy  
 C. Potential energy  
 D. Mechanical energy

- (a) A-(s), B-(p), C-(q), D-(r)  
 (c) A-(q); B-(p); C-(p); D-(p)

**Column-II**

- (p) One fourth  
 (q) Two times  
 (r) Four times  
 (s) Half times

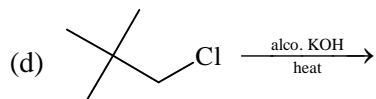
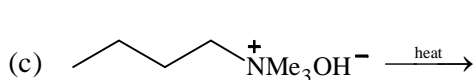
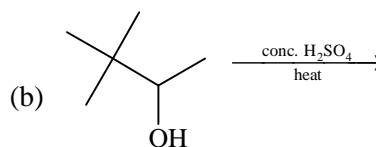
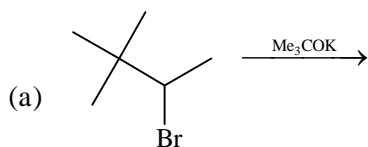
- (b) A-(q), B-(r), C-(p), D-(s)  
 (d) A-(r), B-(s), C-(p), D-(q)

**CHEMISTRY**

**SECTION- I: MULTIPLE CORRECT ANSWERS TYPE**

This section contains 8 multiple choice questions numbered 21 to 28. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

21. In which of the following reaction, Hofmann elimination is the major product?



22. Point out the correct statements amongst the following:

- (a)  $[\text{Cu}(\text{CN})_4]^{2-}$  has square planar geometry and  $sp^2d$  hybridisation  
 (b)  $[\text{Ni}(\text{CN})_6]^{4-}$  is octahedral and Ni has  $d^2sp^3$  hybridisation  
 (c)  $[\text{ZnBr}_4]^{2-}$  is tetrahedral and diamagnetic  
 (d)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  has octahedral geometry and  $sp^3d^2$  hybridization

23. If same quantity of electricity is passed through three electrolytic cells containing  $\text{FeSO}_4$ ,  $\text{Fe}_2(\text{SO}_4)_3$ , and  $\text{Fe}(\text{NO}_3)_3$ , then

- (a) The amounts of iron deposited in  $\text{FeSO}_4$  and  $\text{Fe}_2(\text{SO}_4)_3$  are equal  
 (b) The amount of iron deposited in  $\text{FeSO}_4$  is 1.5 times of the amount of iron deposited in  $\text{Fe}(\text{NO}_3)_3$   
 (c) The amounts of iron deposited in  $\text{Fe}_2(\text{SO}_4)_3$  and  $\text{Fe}(\text{NO}_3)_3$  are equal  
 (d) The same amount of gas is evolved in all three cases at the anode

24. For a 0.1 m solutions each of two solutes X and Y in which solute X behaves as a univalent electrolyte and Y dimerises in solution. The correct statement (s) are
- The b.p. of solution of solute X will be higher than that of Y.
  - The osmotic pressure of the solution of solute Y will be lower than that of X.
  - The freezing point of solution of solute X will be lower than that of Y
  - The relative lowering of V.P. of solution of solute X will be same as that of Y.
25. Select the correct statement regarding 3-methylbutene
- It may be converted into primary alcohol by hydroboration-oxidation reaction
  - It may be converted into tertiary alcohol by acidic hydration
  - It may be converted into a racemic mixture primary alcohol by oxymercuration-demercuration
  - It may be converted into a racemic mixture of secondary alcohols by oxymercuration-demercuration
26. The enthalpy change for the process  $C(\text{graphite}) \longrightarrow C(\text{g})$  is called
- heat of vaporisation
  - heat of sublimation
  - heat of allotropic change
  - heat of atomisation.
27. On mixing equal volumes of the following solutions, the precipitation of AgCl will take place in case of ( $K_{sp}$  for AgCl =  $1.8 \times 10^{-10}$ )
- $10^{-5}$  M AgNO<sub>3</sub> with  $10^{-4}$  M NaCl solution
  - $10^{-4}$  M NaCl with  $10^{-5}$  M AgNO<sub>3</sub> solution
  - $10^{-3}$  M AgNO<sub>3</sub> with  $10^{-8}$  M NaCl solution
  - $10^{-3}$  M NaCl with  $10^{-8}$  M AgNO<sub>3</sub> solution
28. Equal volume of the following solution are mixed. In which can the pH of the resulting solution will be the average pH value of the two solution? Given  $K_a(\text{HCN}) = 10^{-10}$ ,  $K_a(\text{CH}_3\text{COOH}) = K_b(\text{NH}_3)_{\text{aq}}$
- HCl (pH = 2) and NaOH (pH = 12)
  - HCl (pH = 2) and NaOH (pH = 4)
  - HCN (pH = 2) and NaOH (pH = 12)
  - CH<sub>3</sub>COOH (pH = 5) and (NH<sub>3</sub>)<sub>aq</sub> (pH = 9)

### SECTION- II: PARAGRAPH TYPE

This Section contains **4 paragraphs** each describing theory, experiment, data etc. **Eight questions** relate to four paragraphs with two questions on each paragraph. Each question of a paragraph has **only one correct answer** amount the four choice (A), (B), (C) and (D).

#### Paragraph for Question 29 to 31

An organic compound (X) on treatment with CHCl<sub>3</sub> and KOH gives (Y) and (Z) both of which is turn gives the same compound (T) when distilled with Zn.

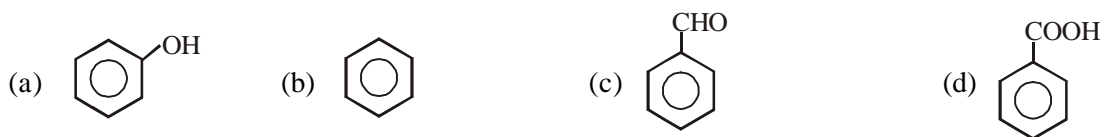
OXidation of (T) yields (S) of formula C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>. The sodium salt of (S) with sodalime gives (P) which can also be obtained by distilling (X).



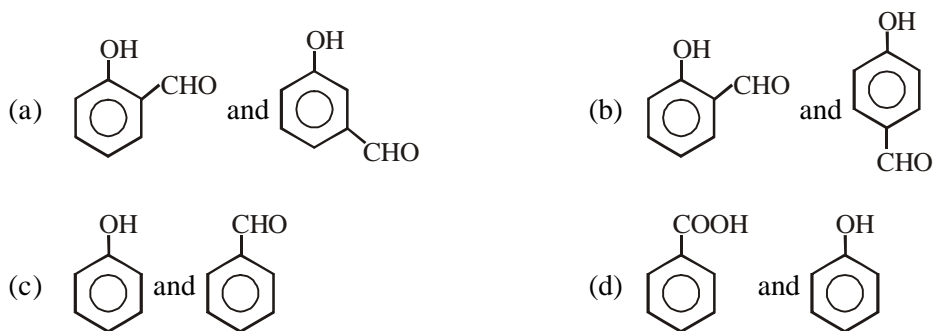
29. The molecular weight of compound (X) is:

- (a) 122                      (b) 94                      (c) 106                      (d) 78

30. The compound (T) is

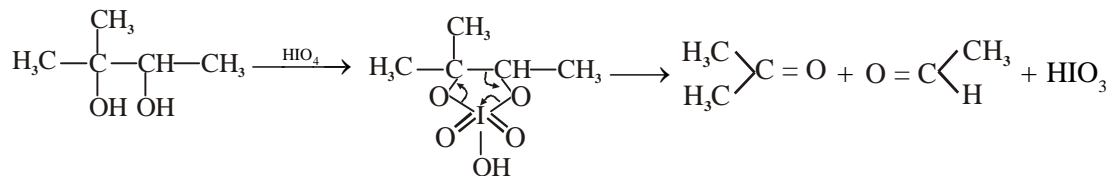



31. Compound (Y) and (Z) could be

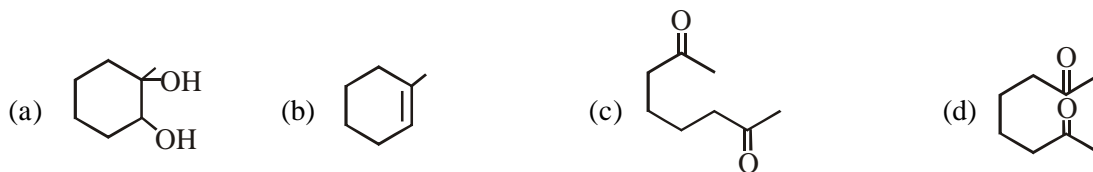


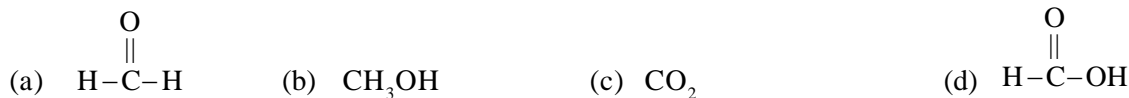
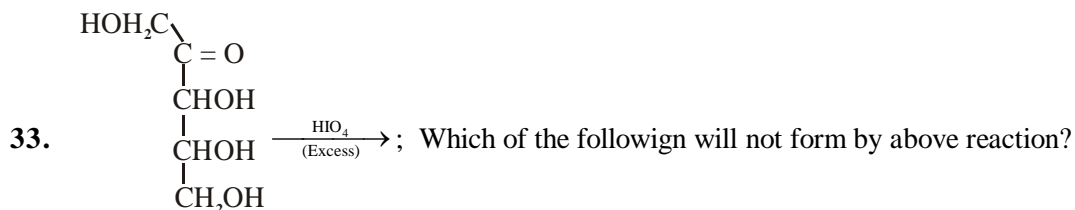
**Paragraph for Question 32 to 34**

1, 2-diols are oxidized to ketones or aldehydes by periodic acid  $\text{HIO}_4$ . Periodic acid reacts with diol to form a cyclic intermediate. The reaction takes place because iodine is in a highly positive oxidation state, so it readily accepts electrons. When the intermediate breaks down, the bond between the two carbons bonded to the OH groups break.

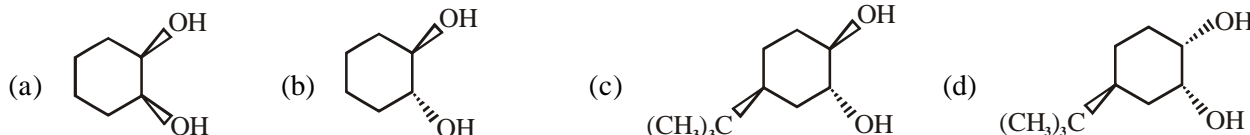


32.   $\xrightarrow[h\nu]{\text{Br}_2}$  A  $\xrightarrow{\text{alc. KOH}}$  B  $\xrightarrow{\text{OsO}_4}$  C  $\xrightarrow{\text{HIO}_4}$  D. I identify D.





34. Which of the following compounds will not react with  $\text{HIO}_4$ ?

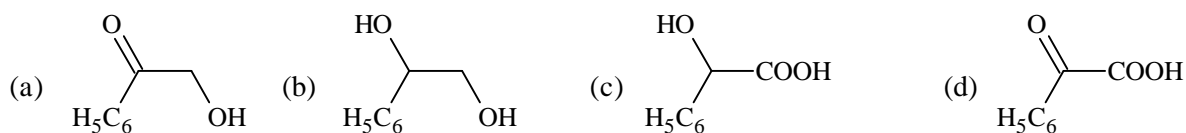


### Paragraph for Question 35 to 36

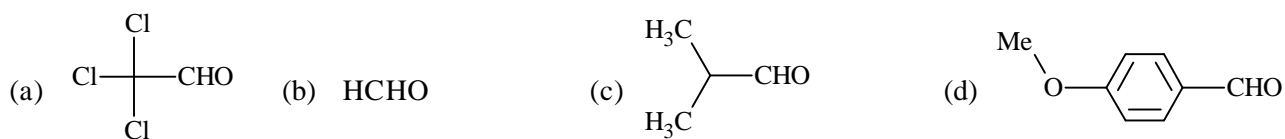
Two important condensation reactions of carbonyl compounds are aldol condensation and Cannizzaro reaction. Aldehydes or ketones having an  $\alpha$ -hydrogen atom in the presence of dilute base form  $\beta$ -hydroxy aldehyde or ketone which on dehydration gives  $\alpha, \beta$ -unsaturated carbonyl compound. Cross aldol condensation or Claisen reaction occurs in a similar way between an aromatic aldehyde (having no  $\alpha$ -H) and an aliphatic carbonyl compound (with  $\alpha$ -H)

Aldehydes having no  $\alpha$ -hydrogen in the presence of concentrated  $\text{NaOH}/\text{KOH}$  undergoes a redox reaction (disproportionation) forming a salt of carboxylic acid and an alcohol. Cross Cannizzaro reaction takes place between different aldehydes having no  $\alpha$ -hydrogen. Intramolecular cannizzaro reaction is also possible.

35. Identify the end product  $\text{C}_6\text{H}_5-\text{COCHCl}_2 \xrightarrow[\Delta]{\text{i) NaOH(aq)}} \text{A} \xrightarrow[\text{H}^+]{\text{NaOH}/\Delta}$



36. Cannizzaro reaction is not given by

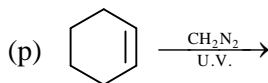


**SECTION- III: MATCHING LIST TYPE**

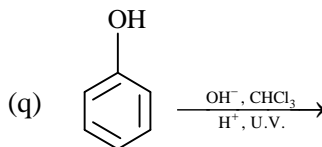
This Section contains **4 multiple choice questions**. Each question has matching lists. The codes for lists have choice (A), (B), (C) and (D) out of which **ONLY ONE** may be correct.

- 37.** A. +ve deviation for Raoult's Law (p)  $\Delta V_{\text{mix}} \neq 0$   
 B. -ve deviation for Raoult's Law (q)  $\Delta S_{\text{mix}} \neq 0$   
 C. Ideal solution (r) Free of attraction between A and B are greater than pure A and pure B  
 D. Solution of  $\text{CHCl}_3$  \*(A) and Acetone (B) (s) Forms minimum boiling azeotrope  
 (t) Force of attraction between A and B are equal to pure A and pure B
- (a) A-(p),(q),(s); B-(p),(q),(r); C-(q),(t); D-(p),(q),(r)  
 (b) A-(p),(q),(r); B-(p),(s),(t); C-(p),(q); D-(s),(t)  
 (c) A-(q),(r); B-(p),(q),(r),(s); C-(s),(t); D-(q),(r),(t)  
 (d) none of these

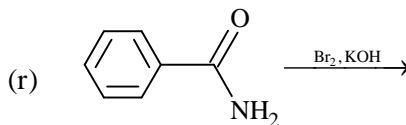
**38.** A. Carbene



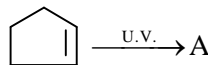
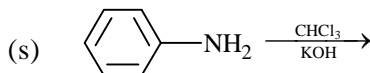
B. Reimer-Tiemann Reaction



C. Hoffmann Bromamide Degradation



D. Bicyclo compounds as product



- (a) A-(p),(q),(s); B-(p),(q); C-(t); D-(q),(r) (b) A-(p),(q),(s),(t); B-(q); C-(r); D-(p),(t)  
 (c) A-(p),(q),(r),(s); B-(r); C-(s); D-(s),(t) (d) none of these

39. A. Compression factor (Z) for ideal gas (p)  $\frac{8a}{27Rb}$   
 B. Z for real gas at low pressure (q)  $1 + \frac{Pa}{RT}$   
 C. Z for real gas at high pressure (r) 1.00  
 D. Critical temperature,  $T_c$  (s)  $1 - \frac{a}{VRT}$
- (a) A-(s), B-(r), C-(q), D-(p) (b) A-(r), B-(s), C-(p), D-(q)  
 (c) A-(r), B-(s), C-(q), D-(p) (d) A-(p), B-(s), C-(q), D-(r)

40. Given:  $A_2 + B_2 \longrightarrow C$ , Eqm. const. = 4,  $C + 2 B_2 \longrightarrow 2 D_2$ , Eqm. const. = 16

**Column-I (Reaction)**

**Column-II (Eqm. Const.)**

- A.  $\frac{1}{2}A_2 + \frac{3}{2}B_2 \longrightarrow D_2$  (p)  $\frac{1}{4}$   
 B.  $2D_2 \longrightarrow A_2 + 3B_2$  (q) 64  
 C.  $A_2 + 3B_2 \longrightarrow 2D_2$  (r)  $\frac{1}{64}$   
 D.  $D_2 \longrightarrow B_2 + \frac{1}{2}C$  (s) 8
- (a) A-(p), B-(q), C-(r), D-(s) (b) A-(p), B-(r), C-(q), D-(s)  
 (c) A-(s), B-(q), C-(r), D-(p) (d) A-(s), B-(r), C-(q), D-(q)

## MATHEMATICS

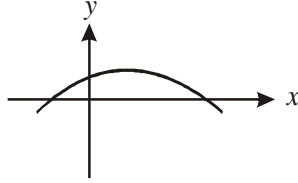
### SECTION- I: MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 multiple choice questions numbered 41 to 48. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

41. If  $|z - 3| = \min \{|z - 1|, |z - 5|\}$ , then  $\text{Re}(z)$  equals to
- (a) 2 (b)  $\frac{5}{2}$  (c)  $\frac{7}{2}$  (d) 4

42. Given that  $x + y + z = 15$  when  $a, x, y, z, b$  are in A.P and  $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{5}{3}$  when  $a, x, y, z, b$  are in H.P. Then
- (a) GM of  $a$  and  $b$  is 3  
 (b) one possible value of  $a + 2b$  is 11  
 (c) A.M of  $a$  and  $b$  is  $b$   
 (d) greatest value of  $a - b$  is 8

43. If the following figure shows the graph of  $f(x) = ax^2 + bx + c$ , then



- (a)  $ac < 0$                       (b)  $bc > 0$                       (c)  $ab > 0$                       (d)  $abc < 0$
44. The middle term in the expansion of  $(x/2 + 2)^8$  is 1120; then  $x$  is equal to
- (a)  $-2$                       (b)  $3$                       (c)  $-3$                       (d)  $2$
45. If  $\Delta(x) = \begin{vmatrix} x^2 - 4x - 3 & 2x + 4 & 13 \\ 2x^2 + 5x - 9 & 4x + 5 & 26 \\ 8x^2 - 6x + 1 & 16x - 6 & 104 \end{vmatrix} = ax^3 + bx^2 + cx + d$ , then
- (a)  $a = 3$                       (b)  $b = 0$                       (c)  $c = 0$                       (d) none of these
46. A fair coin is tossed 99 times. Let  $X$  be the number of times heads occurs. Then  $P(X = r)$  is maximum when  $r$  is
- (a) 49                      (b) 52                      (c) 51                      (d) 50
47. If the focus of the parabola  $x^2 - ky + 3 = 0$  is  $(0, 2)$ , then a value of  $k$  is/are
- (a) 4                      (b) 6                      (c) 3                      (d) 2
48. The angle formed by the positive  $y$ -axis and the tangent to  $y = x^2 + 4x - 17$  at  $(5/2, -3/4)$  is
- (a)  $\tan^{-1}(9)$                       (b)  $\frac{\pi}{2} - \tan^{-1}(9)$                       (c)  $\frac{\pi}{2} + \tan^{-1}(9)$                       (d) none of these

### SECTION- II: PARAGRAPH TYPE

This Section contains **3 paragraphs** each describing theory, experiment, data etc. **Eight questions** relate to four paragraphs with two questions on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

### Paragraph for Question 49 to 51

To study inverse trigonometric functions with full rigour is a big challenge and it requires a purely analytical approach. Almost all results are true in a given interval only. These intervals are discovered when we attempt to prove these methodically. To invert the equality  $y = \sin x$  we write  $\sin^{-1}y = x$  provided  $|y| \leq 1$  and  $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$  otherwise we cannot write it as  $\sin^{-1}y = x$ . To invert the equality  $y = \sin x$  when  $x \notin \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$  we proceed as follows.

We write  $\sin x = \sin x'$  where  $x' \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$  which is always possible since any value in  $[-1, 1]$  is attained by an angle in  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$  through the function  $\sin x$ .

49. If  $x, y \in [-1, 0]$  and  $x^2 + y^2 > 1$ , then  $\sin^{-1}x + \sin^{-1}y$  must be

- (a)  $\sin^{-1}\left[x\sqrt{1-y^2} + y\sqrt{1-x^2}\right]$  (b)  $\pi - \sin^{-1}\left[x\sqrt{1-y^2} + y\sqrt{1-x^2}\right]$   
(c)  $-\pi - \sin^{-1}\left[x\sqrt{1-y^2} + y\sqrt{1-x^2}\right]$  (d) none of these

50. If  $x, y < 0$  and  $xy > 1$ , then  $\tan^{-1}x + \tan^{-1}y$  must be

- (a)  $\tan^{-1}\frac{x+y}{1-xy} - \pi$  (b)  $\tan^{-1}\frac{x+y}{1-xy} + \pi$  (c)  $-\tan^{-1}\frac{x+y}{1-xy} - \pi$  (d) none of these

51. If  $x \in \left[\frac{1}{2}, 1\right]$ , then  $\cos^{-1}x + \cos^{-1}\left(\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right)$  must be equal to

- (a)  $\frac{\pi}{3}$  (b)  $\frac{2\pi}{3}$  (c)  $\frac{5\pi}{6}$  (d) none of these

### Paragraph for Question 52 to 54

Domain of a given function is defined as set of values of  $x$ , for which function is defined or exists, while Range is defined as set of values of function obtained by putting values of  $x \in \text{Domain}$ .

If a function is written as  $f: A \rightarrow B$ , then 'A' is called Domain and 'B' is called co-domain.

Answer the following questions:

52. Range of  $f(x) = {}^{P(x)}C_{Q(x)}$ , where  $P(x) = 19x - 9 - 2x^2$  and  $Q(x) = \sqrt{x-4}$ , is

- (a)  $\{1, 35, 36\}$  (b)  $\{1, 36, 105\}$  (c)  $\{35, 36, 105\}$  (d) none of these

53. The domain of definition of the function  $\sin^{-1} \log_{1/2} \left( x^2 + \frac{3}{4} \right)$  is
- (a)  $\left[ \frac{-\sqrt{5}}{2}, \frac{\sqrt{5}}{2} \right]$       (b)  $\mathbb{R} - \left( \frac{-\sqrt{5}}{2}, \frac{\sqrt{5}}{2} \right)$       (c)  $(0, \infty)$       (d) none of these

54. The range of the function  $f(x) = \sqrt{\sin(\cos x)} + \sqrt{\cos(\sin x)}$  is
- (a)  $[\sqrt{\cos 1}, 1]$       (b)  $[0, 1 + \sqrt{\sin 1}]$   
(c)  $[\sqrt{\cos 1}, 1 + \sqrt{\sin 1}]$       (d)  $[0, 1]$

**Paragraph for Question 55 to 56**

Suppose  $E_1, E_2, E_3$  be three mutually exclusive events such that  $P(E_i) = p_i$  for  $i = 1, 2, 3$ .

55. If  $p_1, p_2, p_3$  are the roots of  $27x^3 - 27x^2 + ax - 1 = 0$ , then value of  $a$  is
- (a) 9      (b) 6      (c) 3      (d) none of these
56.  $P(\text{none of } E_1, E_2, E_3)$  equals
- (a) 0      (b)  $p_1 + p_2 + p_3$   
(c)  $(1 - p_1)(1 - p_2)(1 - p_3)$       (d) none of these

**SECTION- III: MATCHING LIST TYPE**

This Section contains **4 multiple choice questions**. Each question has matching lists. The codes for lists have choice (A), (B), (C) and (D) out of which **ONLY ONE** may be correct.

57. Match List I with List II and select the correct answer using the codes given below the list

- |  |  |
|--|--|
| <p>A. <math>\int_0^{\pi/4} (\tan^n x + \tan^{n-2} x) dx</math></p>           | <p>(p) <math>\frac{n(n-1)(4n+1)}{6}</math></p> |
| <p>B. <math>\frac{\int_0^n [x] dx}{\int_0^n \{x\} dx} =</math></p>           | <p>(q) <math>\frac{1}{n}</math></p>            |
| <p>C. <math>\int_0^{n^2} [\sqrt{x}] dx</math></p>                            | <p>(r) <math>n - 1</math></p>                  |
| <p>D. <math>\int_0^{\pi/2} \frac{1 + n \cos x}{(n + \cos x)^2} dx</math></p> | <p>(s) <math>\frac{1}{n-1}</math></p>          |
- (a) A-(s); B-(r); C-(p); D-(q)      (b) A-(q), B-(r), C-(p), D-(s)  
(c) A-(s), B-(r), C-(q), D-(p)      (d) A-(r), B-(p), C-(p), D-(q)

58. Match the following if a variable line meets  $x$ -axis at  $A$  and  $y$ -axis at  $B$  such that  $AB$  is always equal to  $b$

- |  |                                 |
|--|---------------------------------|
| A. Locus of centroid of $\Delta OAB$     | (p) $x^2 + y^2 = \frac{b^2}{4}$ |
| B. Locus of circumcenter of $\Delta OAB$ | (q) $x^2 + y^2 = \frac{b^2}{9}$ |
| C. Locus of incentre of $\Delta OAB$     | (r) $y = x$                     |
| D. Locus of mid-point of line $AB$       |                                 |
- (a) A-(q), B-(s), C-(p), D-(r)                      (b) A-(q); B-(p); C-(r); D-(p)
- (c) A-(s), B-(r), C-(p), D-(q)                      (d) A-(r), B-(p), C-(s), D-(q)

59. A. The length of the common chord of two circles of radii 3 and 4                      (p) 1

units which intersect orthogonally is  $\frac{k}{5}$ , then  $k$  equals to

- B. The circumference of the circle  $x^2 + y^2 + 4x + 12y + p = 0$  is                      (q) 24  
bisected by the circle  $x^2 + y^2 - 2x + 8y - q = 0$ , then  $p + q$  is equal to
- C. Number of distinct chords of the circle  $2x(x - \sqrt{2}) + y(2y - 1) = 0$ ,                      (r) 32  
chords are passing through the point  $\left(\sqrt{2}, \frac{1}{2}\right)$  and are bisected on  $x$ -axis is
- D. One of the diameters of the circle circumscribing the rectangle ABCD is                      (s) 36  
 $4y = x + 7$ . If A and B are the points  $(-3, 4)$  and  $(5, 4)$ , respectively, then  
the area of the rectangle is
- (a) A-(q), B-(s), C-(p), D-(r)                      (b) A-(q), B-(r), C-(s), D-(p)
- (c) A-(s), B-(r), C-(p), D-(q)                      (d) A-(r), B-(p), C-(q), D-(s)

60. Match the solution of complex polynomials

- |                   |   |
|-------------------|---|
| A. $z^4 - 1 = 0$  | (p) $z = \cos \frac{\pi}{8} + i \sin \frac{\pi}{8}$ |
| B. $z^4 + 1 = 0$  | (q) $z = \cos \frac{\pi}{8} - i \sin \frac{\pi}{8}$ |
| C. $iz^4 + 1 = 0$ | (r) $z = \cos \frac{\pi}{4} + i \sin \frac{\pi}{4}$ |
| D. $iz^4 - 1 = 0$ | (s) $z = \cos 0 + i \sin 0$                         |
- (a) A-(q), B-(p), C-(s), D-(r)                      (b) A-(q), B-(p), C-(r), D-(s)
- (c) A-(s), B-(r), C-(p), D-(q)                      (d) A-(r), B-(p), C-(s), D-(q)



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# JEE-ADVANCE: TEST-14

## TEST SERIES

**PAPER-II**

Time : 3 hrs.

M.M.: 180

**TEST CODE - A**

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### ANSWERS

#### Physics: Section I to III

- |            |          |          |            |          |            |
|------------|----------|----------|------------|----------|------------|
| 1. (a,c)   | 2. (b,c) | 3. (b,c) | 4. (a,c,d) | 5. (a,c) | 6. (a,b,d) |
| 7. (a,b,c) | 8. (a,c) | 9. (c)   | 10. (b)    | 11. (b)  | 12. (a)    |
| 13. (b)    | 14. (a)  | 15. (b)  | 16. (b)    | 17. (a)  | 18. (b)    |
| 19. (d)    | 20. (c)  |          |            |          |            |

#### Chemistry: Section I to III

- |           |           |             |             |             |           |
|-----------|-----------|-------------|-------------|-------------|-----------|
| 21. (a,c) | 22. (a,c) | 23. (b,c,d) | 24. (a,b,c) | 25. (a,b,d) | 26. (b,c) |
| 27. (a,b) | 28. (a,d) | 29. (b)     | 30. (c)     | 31. (b)     | 32. (d)   |
| 33. (b)   | 34. (c)   | 35. (c)     | 36. (a)     | 37. (a)     | 38. (b)   |
| 39. (c)   | 40. (d)   |             |             |             |           |

#### Mathematics: Section I to III

- |           |             |             |           |         |           |
|-----------|-------------|-------------|-----------|---------|-----------|
| 41. (a,d) | 42. (a,b,d) | 43. (a,b,d) | 44. (a,d) | 45. (b) | 46. (a,d) |
| 47. (b,d) | 48. (b,c)   | 49. (c)     | 50. (a)   | 51. (a) | 52. (b)   |
| 53. (a)   | 54. (c)     | 55. (a)     | 56. (a)   | 57. (a) | 58. (b)   |
| 59. (a)   | 60. (c)     |             |           |         |           |