

# FIITJEE - JEE (Main)

## PHYSICS, CHEMISTRY & MATHEMATICS BATCHES: Two Year CRP426(R & W) PHASE TEST – V Q.P. CODE: 101102

Time Allotted: 3 Hours

Maximum Marks: 300

- Do not open this Test Booklet until you are asked to do so.
- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

### Important Instructions

**Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.**

#### A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections**.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. Each **Section** is further divided into **Two Parts: Part-A & B** in the OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices ext. except the Admit Card inside the examination hall / room.

#### B. Filling of OMR Sheet:

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with **Blue/Black Ball Point Pen** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.
4. **Do not fold or make any stray marks on the Answer Sheet.**

#### C. Marking Scheme for All Two Parts:

- (i) **Part-A (01-20)** – Contains Twenty (20) multiple choice objective questions which have four (4) options each and only one correct option. Each question carries **+4 marks** which will be awarded for every correct answer and **-1 mark** will be deducted for every incorrect answer.
- (ii) **Part-B (01-05)** contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals. If the answer 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) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

Name of the Candidate : \_\_\_\_\_

Batch : \_\_\_\_\_ Date of Examination : \_\_\_\_\_

Enrolment Number : \_\_\_\_\_

# Physics

## PART – A

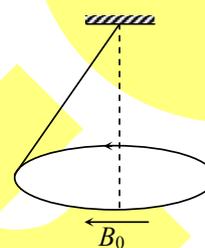
### Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. In an induction coil, the coefficient of mutual induction is 4 henry. If a current of 5 ampere in the primary coil is cut off in  $\frac{1}{1500}$  s, the emf at the terminals of the secondary coil will be  
 (A) 15 kV (B) 60 kV (C) 10 kV (D) 30 kV

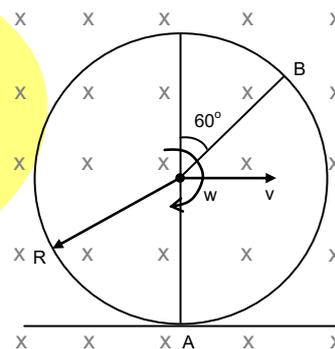
2. A uniform current carrying ring of mass  $m$  and radius  $R$  is connected by a massless string as shown. A uniform magnetic field  $B_0$  exist in the region to keep the ring in horizontal position, then the current in the ring is:

- (A)  $\frac{mg}{\pi R B_0}$  (B)  $\frac{mg}{R B_0}$  (C)  $\frac{mg}{3\pi R B_0}$  (D)  $\frac{mgl}{\pi R^2 B_0}$



3. A conducting wheel is rolling on the ground in a uniform magnetic field  $B_0$  then the emf induced between points A and B;  $V_A - V_B$  will be

- (A)  $B_0 \omega^2 (\sqrt{3} R)$   
 (B)  $-B_0 \omega^2 \sqrt{3} R$   
 (C)  $B_0 \omega^2 \sqrt{2} R$   
 (D)  $-B_0 \omega^2 \left(\frac{\sqrt{5}}{2}\right) R$



4. Magnetic flux linked with a stationary loop of resistance  $R$  varies with respect to time during the time period  $T$  has follows:

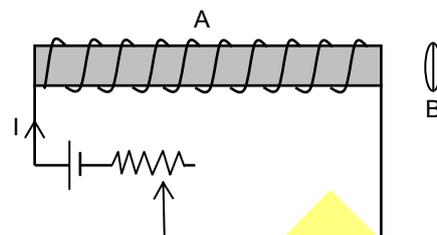
$$\phi = aT(T - t)$$

The amount of heat generated in the loop during that time. (inductance of the coil is negligible) is

- (A)  $\frac{aT}{3R}$  (B)  $\frac{a^2 T^2}{3R}$  (C)  $\frac{a^2 T^2}{R}$  (D)  $\frac{a^2 T^3}{3R}$

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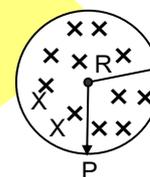
5. An aluminium ring B faces an electromagnet A. The current through A can be changed. Then  
 (A) B will not experience any force  
 (B) For increasing I, B is repelled  
 (C) for decreasing I, B is attracted  
 (D) for decreasing I, B is repelled.



6. If a dc of value of I amp is superimposed on an alternating current  $i = I_0 \sin \omega t$  flowing through a wire, the effective value of the resulting current in the circuit is  
 (A)  $(I^2 + I_0^2)^{1/2}$  (B)  $\left(I_0^2 + \frac{I^2}{2}\right)^{1/2}$  (C)  $\left[I^2 + \frac{1}{2}I_0^2\right]^{1/2}$  (D)  $\left(I + \frac{I_0}{2}\right)^{1/2}$

7. Huygen's conception of secondary waves  
 (A) helps us to find the focal length of a thick lens.  
 (B) is a geometrical method to find the new position of a wave-front.  
 (C) is used to determine the velocity of light.  
 (D) is used to explain polarization of light.

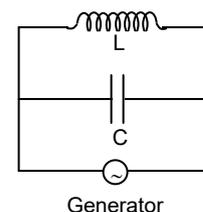
8. A uniform magnetic field of induction B is confined to a cylindrical region of radius R. The magnetic field is increasing at the rate of  $\left(\frac{dB}{dt}\right)$  (tesla/sec).



An electron of charge e, placed at point P on the periphery of the field experiences an initial acceleration of

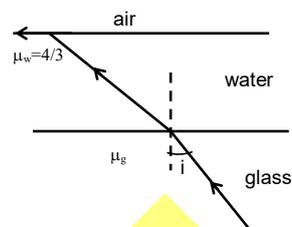
- (A)  $\frac{1}{2} \frac{eR}{m} \frac{dB}{dt}$  towards left (B)  $\frac{1}{2} \frac{eR}{m} \frac{dB}{dt}$  towards right  
 (C)  $\frac{eR}{m} \frac{dB}{dt}$  towards left (D) zero
9. An inductor coil stores energy U when a current i is passed through it and dissipates energy at the rate of P. The time constant of the circuit when this coil is connected across a battery of zero internal resistance is  
 (A)  $\frac{4U}{P}$  (B)  $\frac{U}{P}$  (C)  $\frac{2U}{P}$  (D)  $\frac{2P}{U}$

10. For the circuit shown in the figure, the current through the inductor is 0.6 A, while the current through the capacitor is 0.4 A. The current drawn from the generator is  
 (A) 1.0 A (B) 0.4 A  
 (C) 0.6 A (D) 0.2 A



Space For Rough Work

11. A ray of light is incident at an angle  $i$  at the glass water interface. It emerges finally parallel to the surface of water – air interface. Then the value of  $\mu_g$  would be



- (A)  $\frac{4}{3 \sin i}$  (B)  $\frac{1}{\sin i}$   
 (C)  $\frac{4}{3}$  (D) 1.5

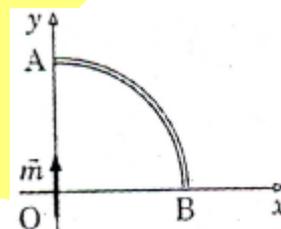
12. Two coherent sources of intensity ratio 100:1, interfere what is the (approximate) ratio of the intensity between the maxima and minima in the interference pattern?

- (A) 10:1 (B) 5:2 (C) 3:2 (D) 11:9

13. Shape of wavefronts coming out from a point source, a long linear source and a spherical symmetric source are respectively:

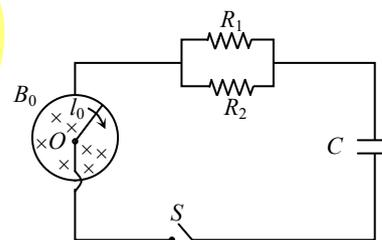
- (A) Conical, cylindrical and plane. (B) Circular, cylindrical and plane.  
 (C) Spherical, cylindrical and plane. (D) Spherical, cylindrical and spherical.

14. Consider a quarter circular conducting ring of large radius  $r$  with its centre at the origin, where a magnetic dipole of moment  $\vec{m}$  is placed as shown in the figure. If the ring rotates at a constant angular velocity  $\omega$  about the y-axis, electromotive force induced between its ends is



- (A) Zero (B)  $\mu_0 m \omega / (2\pi r)$   
 (C)  $\mu_0 m \omega / (4\pi r)$  (D)  $\mu_0 m \omega / (8\pi r)$

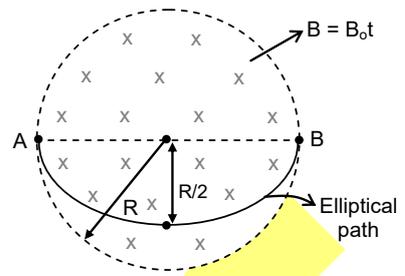
15. There is a small metallic ring of radius  $l_0$  and having negligible resistance placed perpendicular to a constant magnetic field  $B_0$ . One end of a rod is hinged at the centre of ring O and other end is placed on the ring. Now rod is rotated with constant angular velocity  $\omega_0$  by some external agent and circuit is connected as shown in the figure, initially switch is open and capacitor is uncharged. If switch S is closed at  $t = 0$ , then calculate heat loss from the resistor  $R_2$  from  $t = 0$  to the instant when voltage across the capacitor becomes  $V_0$ . (Assume plane of ring to be horizontal and friction to be absent at all the contacts). (Assume,  $R_2 = 2R_1$ ,  $B_0 l_0^2 \omega_0 = 4V_0$ )



- (A)  $\frac{1}{2} CV_0^2$  (B)  $\frac{1}{6} CV_0^2$  (C)  $\frac{2}{3} CV_0^2$  (D)  $\frac{1}{3} CV_0^2$

Space For Rough Work

16. There is a uniform time varying magnetic field in a circular region as shown in the figure. Find out the potential difference across 2 point along an elliptical path as shown in figure.

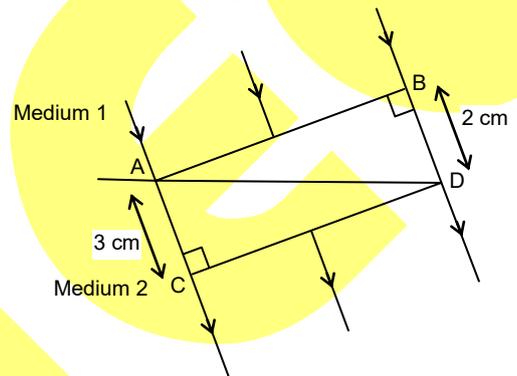


- (A)  $\frac{\pi R^2}{2} B_0$  (B)  $\frac{\pi R^2}{2} B_0$   
 (C)  $\frac{\pi R^2}{4} B_0$  (D)  $\frac{\pi R^2}{5} B_0$

17. A points source is emitting light of wavelength  $\lambda$ . Phase difference between two wavefronts is  $\pi/3$ , then distance between them will be

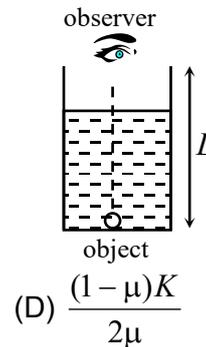
- (A)  $\frac{\lambda}{3}$  (B)  $\frac{\lambda}{6}$  (C)  $\frac{\lambda}{4}$  (D)  $\frac{\lambda}{2}$

18. Figure shows wavefront AB from medium 1 refracting as wavefront CD in medium 2. Refractive index of medium 2 w.r.t. medium 1 is



- (A)  $\frac{3}{2}$  (B)  $\frac{2}{3}$   
 (C)  $\frac{9}{4}$  (D)  $\frac{4}{9}$

19. A cylinder is filled with a liquid of refractive index  $\mu$ . The radius of the cylinder is decreasing at a constant rate  $K$ . The volume of the liquid inside the container remains constant at  $V$ . The observer and the object  $O$  are in a state of rest and at a distance  $L$  from each other. The apparent velocity of the object as seen by the observer, (when radius of cylinder is  $r$ )



- (A)  $\frac{(1 - \mu)2KV}{(\pi \mu r^3)}$  (B)  $\frac{(1 - \mu)2KV}{(\pi \mu Lr^2)}$  (C)  $\frac{(1 - \mu)2K}{\mu}$  (D)  $\frac{(1 - \mu)K}{2\mu}$

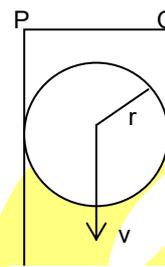
20. Optical path for yellow light is same if it passes through 4cm of glass or 6 cm of water. If the refractive index of water  $4/3$ , what is the refractive index of glass?

- (A) 2 (B) 1.5 (C)  $\frac{16}{9}$  (D)  $\frac{3}{4}$

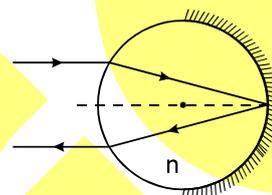
Space For Rough Work

**PART-B**  
**Numerical Type**

1. A vertical ring of radius 'r' and resistance 'R' slips vertically between two frictionless and resistance less vertical rails. The rails which are joined at top there is uniform magnetic field B perpendicular to plane of ring and the rails. When speed of ring is v, current induced in section PQ is  $\frac{nBv}{R}$  find n

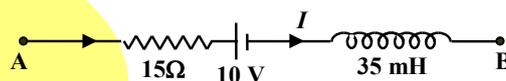


2. A transparent cylinder has its right half polished so as to act as a mirror. A paraxial light ray is incident from left that is parallel to principal axis, exits parallel to the incident ray as shown. Find the refractive index n of the material of the cylinder.

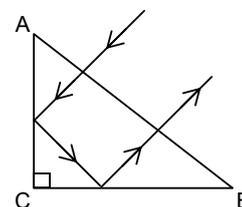


3. Fringes are produced using light of wavelength  $\lambda = 4800 \text{ \AA}$  in a double-slit experiment. One of the slits is covered by a thin plate of glass of refractive index 1.4 and other slit by another plate of glass of double the thickness and of refractive index 1.7. During this process, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the centre. If the thickness of thin glass plate is  $n \times 10^{-7} \text{ m}$ , then n =

4. The network shown in Figure is part of a complete circuit. If at a certain instant the current (I) is 5A, and is decreasing at a rate of  $10^3 \text{ A/s}$ , then  $V_B - V_A =$



5. A ray of light is incident normally on face AB of an isosceles right angled prism as shown in figure. The least value of refractive index of the prism must be just greater than k, then 'k' is \_\_\_\_\_



Space For Rough Work

# Chemistry

## PART – A

### Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

- A diatomic molecule dimerises as well as dissociates at the same temperature in two different solvents. If the degree of dimerisation and that of dissociation are equal to 0.8. What is the ratio of their van't Hoff factor, i.e.,  $i(\text{dimerisation}) : i(\text{dissociation})$   
 (A) 1 : 6                      (B) 1 : 3                      (C) 1 : 8                      (D) 1 : 5
- For which of the following aqueous solution, there is maximum difference between the normal and abnormal colligative properties?  
 (A) 0.1 m  $\text{C}_6\text{H}_{12}\text{O}_6$                       (B) 0.1 m  $\text{CH}_3\text{COOH}$   
 (C) 0.1 m  $\text{HCOOH}$                       (D) 0.1 m  $\text{CH}_3\text{OH}$
- Which of the following aqueous solution is colourless?  
 (A)  $\text{Cu}(\text{NO}_3)_2$                       (B)  $\text{Zn}(\text{NO}_3)_2$                       (C)  $\text{Fe}(\text{NO}_3)_2$                       (D)  $\text{Cr}(\text{NO}_3)_3$
- The relation between the molar conductance ( $\Lambda_m$ ) and equivalent conductance ( $\Lambda_e$ ) of the solution of  $\text{MgCl}_2 \cdot \text{KCl} \cdot 6\text{H}_2\text{O}$  is  
 (A)  $\Lambda_m = \Lambda_e \times 8$                       (B)  $\Lambda_m = \Lambda_e \times 3$                       (C)  $\Lambda_e = \Lambda_m \times 3$                       (D)  $\Lambda_e = \Lambda_m \times 8$
- $\text{MnO}_2 + \text{SO}_3^{2-} + \text{H}^+ \longrightarrow \text{Mn}^{2+} + (\text{X}) + \text{H}_2\text{O}$   
 In above reaction(X) may be  
 (A)  $\text{S}_2\text{O}_3^{2-}$                       (B)  $\text{S}_2\text{O}_6^{2-}$                       (C)  $\text{S}_2\text{O}_4^{2-}$                       (D)  $\text{S}_4\text{O}_6^{2-}$
- $\text{Pb}(\text{NO}_3)_2$  (excess) +  $\text{CrO}_2\text{Cl}_2 + \text{NaOH} \xrightarrow{25^\circ\text{C}}$  Products  
 Which of the following precipitates can be formed in the above reaction?  
 (A)  $\text{PbCrO}_3$  and  $\text{PbCl}_2$                       (B)  $\text{PbCrO}_4$  and  $\text{PbCl}_2$   
 (C)  $\text{PbCr}_2\text{O}_7$  and  $\text{PbCl}_4$                       (D)  $\text{Na}_2\text{PbO}_2$  and  $\text{PbCl}_4$
- Which of the following gas turns the orange colour of acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution to green?  
 (A)  $\text{CO}_2$                       (B)  $\text{SO}_3$                       (C)  $\text{SO}_2$                       (D)  $\text{SiO}_2$
- How many O – O bond(s) is/are present in a molecule of  $\text{H}_2\text{S}_2\text{O}_8$ ?  
 (A) 1                      (B) 2                      (C) 3                      (D) 4

Space For Rough Work

9. Which of the following gases react to form a solid product and water? The solid is insoluble in water?  
(A)  $\text{NO}_2$  and  $\text{NO}$  (B)  $\text{SO}_2$  and  $\text{H}_2\text{S}$  (C)  $\text{SO}_2$  and  $\text{SO}_3$  (D)  $\text{O}_2$  and  $\text{H}_2\text{S}$
10. What would be the vapour pressure of a solution which contains 2 moles of liquid A (vapour pressure = 400 mm) and 3 moles of liquid B (vapour pressure = 600 mm)?  
(A) 480 mm (B) 520 mm (C) 2600 mm (D) 1600 mm
11. Neon is preferable to  $\text{O}_2$  for use in electric bulbs, because of  
(A) it is attracted towards the electrodes easily than  $\text{O}_2$   
(B) higher ionization energy of Ne than  $\text{O}_2$   
(C) emission of electrons by neon  
(D) neon easily gets adsorbed on the filament than  $\text{O}_2$
12. Which of the following substance can intensify the blue colour of aqueous  $\text{CuSO}_4$  solution?  
(A)  $\text{NaOH}$  (B)  $\text{NH}_4\text{OH}$  (C)  $\text{Al}(\text{OH})_3$  (D)  $\text{ClOH}$
13. Xenon reacts with  $\text{F}_2$  directly unlike other halogens because  
(A) the electron affinity of  $\text{F}_2$  has the highest value among halogens  
(B)  $\text{Xe-F}$  is the strongest bond than other Xe to halogen bonds  
(C)  $\text{F}_2$  is the strongest reducing agent than other halogens  
(D)  $\text{F}_2$  is the most polar molecule among the halogens
14. Which of the following electronic configuration of the metal ion, in its octahedral complex, provides maximum paramagnetic property according to crystal field theory?  
(A)  $t_{2g}^6 e_g^2$  (B)  $t_{2g}^4 e_g^2$  (C)  $t_{2g}^3 e_g^2$  (D)  $t_{2g}^5 e_g^2$
15. What is the volume(V) of an aqueous solution of an electrolyte, according to the following data?  
Conductivity of water =  $K_1$   
Conductivity of solution =  $K_2$   
Molar conductivity of solution =  $\Lambda_m$   
(A)  $V = \frac{\Lambda_m}{K_2 + K_1}$  (B)  $V = \frac{\Lambda_m}{K_2 - K_1}$   
(C)  $V = \Lambda_m (K_2 - K_1)$  (D)  $V = \Lambda_m (K_2 + K_1)$
16. Which complex will absorb radiation of shortest wavelength for the electronic transition ( $t_{2g} \rightarrow e_g$ )?  
(A)  $[\text{CoF}_6]^{3-}$  (B)  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (C)  $[\text{CoCl}_6]^{3-}$  (D)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
17. Choose correct statement(s) regarding copper?  
(I) It has positive reduction potential among the 3d series elements.  
(II) It contains more number of d-electron than s-electrons  
(III) In aqueous solution  $\text{Cu}^{2+}$  ion is more stable than  $\text{Cu}^+$  ions  
(IV) Both  $\text{Cu}^+$  and  $\text{Cu}^{2+}$  contain same number of unpaired electrons.  
(A) I, IV (B) I, II, III (C) II, IV (D) II, III, IV

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Space For Rough Work

18.  $P_4O_{10} + H_2O \longrightarrow (X) \xrightarrow{\text{Heat}} H_4P_2O_7 + H_2O$   
 In above reaction(X) is  
 (A)  $P_4O_{10} \cdot xH_2O$  (B)  $H_3PO_3$  (C)  $H_3PO_4$  (D)  $H_3PO_2$
19. Which of the following statement(s) is incorrect for  $Ni(CO)_4$ ?  
 (A) The hybridization of nickel is  $sp^3$   
 (B) It contains no unpaired electrons.  
 (C) The principal quantum number of the atomic orbitals of Ni, which undergo hybridization is 4.  
 (D) It has planar shape
20. 

0.4 m Sugar solution
(I)

0.4 m NaCl solution
(II)

  
 (A) Ease of formation of ice: I > II (B) Vapour pressure over solution: I < II  
 (C) Elevation in boiling point: I > II (D) Abnormal colligative property: I > II

**PART-B**  
**Numerical Type**

1.  $Sc^{2+}, Ti^{4+}, Cr^{3+}, Ni^{2+}, Cu^+, Ag^+, Mn^{2+}, Fe^{2+}$  and  $Cd^{2+}$   
 In how many of the above ion(s) d-d transition(s) do(es) not take place?
2.  $FeCl_3 + K_4[Fe(CN)_6] \longrightarrow Fe_4[Fe(CN)_6]_3 \downarrow$   
Blue precipitate  
 The precipitate was taken in a container and 800 mL of 5 M NaOH solution was added to it.  
 If  $\frac{1}{x}$  mole of the precipitate is dissolved in NaOH, what is the value of x?
3. The vapour pressure of an aqueous solution of salt  $MX(\alpha = 1)$  is 750 mm of Hg at 373 K. If the mole fraction of the solute is expressed as  $1/x$ , what is x?
4. How much Faraday of electricity has to be passed through water in order to obtain 22.4 L of dioxygen gas at 1 atm and 273 K.
5.  $PCl_5 + H_2O \longrightarrow (X) + (Y)$   
 $\downarrow$   
 $H_2O$   
 $H_3PO_4 + (Y)$   
 If a = Number of hybrid orbitals of the central atom in (X), participate in bond formation.  
 b = Number of covalent bonds present in (Y)  
 What is the sum of (a + b)?

Space For Rough Work

# Mathematics

## PART – A

### Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

- A unit vector parallel to the line of intersection of the planes  $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$  and  $\vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = 4$  is

(A)  $\frac{2\hat{i} + 5\hat{j} + 3\hat{k}}{\sqrt{38}}$  (B)  $\frac{2\hat{i} - 5\hat{j} + 3\hat{k}}{\sqrt{38}}$  (C)  $\frac{2\hat{i} + 5\hat{j} - 3\hat{k}}{\sqrt{38}}$  (D)  $\frac{-2\hat{i} + 5\hat{j} - 3\hat{k}}{\sqrt{38}}$
- Area bounded by the curve  $f(x) = \frac{x^2 - 1}{x^2 + 1}$  and line  $y = 1$  is

(A)  $\pi$  (B)  $2\pi$  (C)  $\frac{\pi}{2}$  (D)  $4\pi$
- The three vectors  $\hat{i} + \hat{j}$ ,  $\hat{j} + \hat{k}$ ,  $\hat{k} + \hat{i}$  taken two at a time from three planes. The three unit vectors drawn perpendicular to these three planes from a parallelepiped of volume?

(A)  $\frac{1}{3\sqrt{3}}$  (B)  $\frac{5}{3\sqrt{3}}$  (C)  $\frac{3\sqrt{3}}{4}$  (D)  $\frac{4}{3\sqrt{3}}$
- For a given matrix  $A = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$  which of the following statement holds good?

(A)  $A = A^{-1} \forall \theta \in \mathbb{R}$  (B) A is symmetric for  $\theta = (2n + 1)\frac{\pi}{2}$ ,  $n \in \mathbb{I}$   
 (C) A is an orthogonal matrix (D) A is skew symmetric for  $\theta = n\pi$ ,  $n \in \mathbb{I}$
- The area enclosed by the curves  $y = \cos x$ ,  $y = 1 + \sin 2x$ ,  $x = 0$  and  $x = \frac{3\pi}{2}$  equals

(A)  $\frac{3\pi}{2} - 2$  (B)  $\frac{3\pi}{2}$  (C)  $2 + \frac{3\pi}{2}$  (D)  $1 + \frac{3\pi}{2}$
- A function  $y = f(x)$  satisfies the condition  $f'(x) \sin x + f(x) \cos x = 1$ ,  $f(x)$  being bounded when  $x \rightarrow 0$  if  $I = \int_0^{\pi/2} f(x) dx$ , then

(A)  $\frac{\pi}{2} < I < \frac{\pi^2}{2}$  (B)  $\frac{\pi}{2} < I < \frac{\pi^2}{4}$  (C)  $1 < I < \frac{\pi}{2}$  (D)  $0 < I < 1$

Space For Rough Work

7. Area(in sq. units) of the region outside  $\frac{|x|}{2} + \frac{|y|}{3} = 1$  and inside the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$  is  
 (A)  $3(4 - \pi)$  (B)  $3(\pi - 2)$  (C)  $6(\pi - 2)$  (D)  $6(4 - \pi)$
8. Consider the differential equation  $y^2 dx + \left(x - \frac{1}{y}\right) dy = 0$ . If  $y(1) = 1$ , then  $x$  is given by:  
 (A)  $4 - \frac{2}{y} - \frac{e^{1/y}}{e}$  (B)  $3 - \frac{1}{y} + \frac{e^{1/y}}{e}$  (C)  $1 + \frac{1}{y} - \frac{e^{1/y}}{e}$  (D)  $1 - \frac{1}{y} + \frac{e^{1/y}}{e}$
9. For unit vectors  $\vec{b}$  and  $\vec{c}$  and any non zero vector  $\vec{a}$ , the value of  $\left\{ \left( (\vec{a} + \vec{b}) \times (\vec{a} + \vec{c}) \right) \times (\vec{b} \times \vec{c}) \right\} \cdot (\vec{b} + \vec{c})$  is  
 (A)  $|\vec{a}|^2$  (B)  $2|\vec{a}|^2$  (C)  $3|\vec{a}|^2$  (D) none of these
10. If the system of linear equations,  $x + 2ay + az = 0$ ,  $x + 3by + bz = 0$  and  $x + 4cy + cz = 0$  has a non - zero solution, then  $a, b, c$  satisfy:  
 (A)  $2b = a + c$  (B)  $b^2 = ac$  (C)  $2ac = ab + bc$  (D)  $2ab = ac + bc$
11. Let  $A$  and  $B$  are square matrices of same order satisfying  $AB = A$  and  $BA = A$  then  $(A^{2019} + B^{2019})^{2020}$  is equal to  
 (A)  $A+B$  (B)  $2020(A+B)$  (C)  $2^{2019}(A+B)$  (D)  $2^{2020}(A+B)$
12. General solution of  $\frac{dy}{dx} = 2y \tan x + \tan^2 x$ , is equal to:  
 (A)  $y \cdot \cos^2 x = \frac{x}{2} - \frac{1}{4} \sin 2x + c$  (B)  $y \cdot \sin^2 x = \frac{x}{2} - \frac{\cos 2x}{4} + c$   
 (C)  $y \cdot \cos^2 x = \frac{x}{4} - \frac{1}{2} \sin 2x + c$  (D)  $y \cdot \sin^2 x = \frac{x}{4} - \frac{1}{2} \cos 2x + c$
13. The area of the plane figure bounded by lines  $y = \sqrt{x}$ ,  $x \in [0, 1]$ ,  $y = x^2$ ,  $x \in [1, 2]$  and  $y = -x^2 + 2x + 4$ ,  $x \in [0, 2]$  is  
 (A)  $\frac{10}{7}$  (B)  $\frac{26}{3}$  (C)  $\frac{3}{5}$  (D)  $\frac{4}{3}$

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14. The reflection of the point A (1, 0, 0) in the line  $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$  is  
 (A) (3, -4, -2) (B) (5, -8, -4) (C) (1, -1, -10) (D) (2, -3, 8)
15. The image of the line  $\frac{x-1}{3} = \frac{y-3}{1} = \frac{z-4}{-5}$  in the plane  $2x - y + z + 3 = 0$  is the line  
 (A)  $\frac{x+3}{3} = \frac{y-5}{1} = \frac{z-2}{-5}$  (B)  $\frac{x+3}{-3} = \frac{y-5}{-1} = \frac{z+2}{5}$   
 (C)  $\frac{x-3}{3} = \frac{y+5}{1} = \frac{z-2}{-5}$  (D)  $\frac{x-3}{-3} = \frac{y+5}{-1} = \frac{z-2}{5}$
16. The general solution of differential equation  $(1 + \tan y)(dx - dy) + 2x dy = 0$  is  
 (A)  $x(\sin y + \cos y) = \sin y + c \cdot e^y$  (B)  $x(\sin y + \cos y) = \sin y + c \cdot e^{-y}$   
 (C)  $y(\sin x + \cos x) = \sin x + c \cdot e^x$  (D)  $y(\sin x + \cos x) = \cos x + c \cdot e^{-x}$
17. Suppose A is a  $3 \times 3$  skew symmetric matrix. Let  $B = (I + A)^{-1} (I - A)$ . Then  
 (A) B is orthogonal (B) B is skew symmetric  
 (C)  $B^2 = O$  (D) B is a diagonal matrix
18. If  $\vec{a}$  and  $\vec{b}$  be two non-collinear unit vectors such that  $\vec{a} \times (\vec{a} \times \vec{b}) = \frac{1}{2} \vec{b}$  then the angle between  $\vec{a}$  and  $\vec{b}$  is equal to:  
 (A)  $\frac{\pi}{2}$  (B)  $\frac{\pi}{4}$   
 (C) information are inconsistent (D) none of the above
19. Let vectors  $\vec{a}, \vec{b}, \vec{c}$  be three vectors of magnitude 2, 3, 5 respectively, satisfying  $[[\vec{a} \ \vec{b} \ \vec{c}]] = 30$ . If  $(2\vec{a} + \vec{b} + \vec{c}) \cdot ((\vec{a} \times \vec{c}) \times (\vec{a} - \vec{c}) + \vec{b}) = k$ . Then K =  
 (A) 302 (B) 309 (C) 310 (D) 312
20. The solution of the differential equation  $\frac{dy}{dx} = \frac{(2xy)(1 + e^{2x}) - x^2 y e^x}{x^2(1 + e^{2x})}$  is  
 (A)  $\tan^{-1}(e^x) = \ln \left| \frac{y^2}{x} \right| + c$  (B)  $\tan^{-1}(e^x) = \ln \left| \frac{x^2}{y} \right| + c$   
 (C)  $e^{2x} = e^x + \ln \left| \frac{x^2}{y} \right| + c$  (D) None of these

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**PART-B**  
**Numerical Type**

1. Let three matrices  $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ ,  $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$ , then  

$$\text{tr}(A) + \text{tr}\left(\frac{A(BC)}{2}\right) + \text{tr}\left(\frac{A(BC)^2}{2^2}\right) + \text{tr}\left(\frac{A(BC)^3}{2^3}\right) + \dots = \infty$$
2. If 3<sup>rd</sup> order determinants are formed using elements 1 or -1, then maximum possible value of such determinant is
3. Let M be the  $2 \times 2$  matrix such that  $M \begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$  and  $M^2 \begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ . If  $x_1$  and  $x_2$  are two values of x for which  $|M - xI| = 0$ , where I is identity matrix of order 2 then value of  $x_1^2 + x_2^2 =$
4. If  $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$  is the adjoint of a  $3 \times 3$  matrix A and  $|A| = 4$ , then  $\alpha$  is equal to
5. If the vector  $p\hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} + q\hat{j} + \hat{k}$  and  $\hat{i} + \hat{j} + r\hat{k}$ , ( $p \neq q \neq r \neq 1$ ) are coplanar, then the value of  $pqr - (p + q + r)$  is

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# FIITJEE INTERNAL TEST

BATCHES: Two Year CRP426(R & W)\_PT-5

PHYSICS, CHEMISTRY & MATHEMATICS

JEE MAIN-PHASE

ANSWER KEY

Paper Code  
101102

## SECTION – I

(PHYSICS)

### PART – A

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. D  | 2. A  | 3. B  | 4. D  |
| 5. D  | 6. C  | 7. B  | 8. A  |
| 9. C  | 10. D | 11. B | 12. C |
| 13. C | 14. C | 15. A | 16. C |
| 17. B | 18. B | 19. A | 20. A |

### PART – B

- |                               |      |       |           |
|-------------------------------|------|-------|-----------|
| 1. 8                          | 2. 2 | 3. 24 | 4. -50.00 |
| 5. 1.41 (range: 1.40 to 1.42) |      |       |           |

## SECTION – II

(CHEMISTRY)

### PART – A

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. B  | 2. C  | 3. B  | 4. B  |
| 5. B  | 6. B  | 7. C  | 8. A  |
| 9. B  | 10. B | 11. B | 12. B |
| 13. B | 14. C | 15. B | 16. B |
| 17. B | 18. C | 19. D | 20. A |

### PART – B

- |      |      |        |      |
|------|------|--------|------|
| 1. 4 | 2. 3 | 3. 152 | 4. 4 |
| 5. 5 |      |        |      |

## SECTION – III (MATHEMATICS)

### PART – A

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. A  | 2. B  | 3. D  | 4. C  |
| 5. C  | 6. B  | 7. C  | 8. C  |
| 9. D  | 10. C | 11. C | 12. A |
| 13. B | 14. B | 15. A | 16. B |
| 17. A | 18. C | 19. B | 20. C |

### PART – B

- |       |      |      |       |
|-------|------|------|-------|
| 1. 6  | 2. 4 | 3. 5 | 4. 11 |
| 5. -2 |      |      |       |