



# VIBRANT ACADEMY

(India) Private Limited

B-41, Road No.2, Indraprastha Industrial Area, Kota-324005 (Raj.)

Tel. : (0744) 3507788, DLP : 7340042900, Fax : (0744) 2423405

Email: admin@vibrantacademy.com Website : www.vibrantacademy.com

Website : dlp.vibrantacademy.com

**VSAT (VIBRANT SCHOLARSHIP ADMISSION TEST)**

**OFFLINE SAMPLE PAPER**

**XII PASSED (GOOGOL COURSE-2025-26)**

Time : 2 Hours

Maximum Marks : 240

Please read the instructions carefully.

## INSTRUCTIONS

### A. General :

1. This booklet is your Question Paper containing **60** questions.
2. The **question paper CODE** is printed on the right hand top corner of this sheet and on the back page of this booklet.
3. The question paper contains **2** blank pages for your rough work. No additional sheets will be provided for rough work.
4. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
5. Fill in the boxes provided below on this page and also write your **Name** and **Regn. No.** in the space provided on the back page of this booklet.
6. The answer sheet, a machine-readable Objective Response Sheet (**ORS**), is provided separately.
7. **DO NOT TAMPER WITH / MUTILATE THE ORS OR THE BOOKLET.**
8. Do not open the question-paper booklet before being instructed to do so by the invigilators.

### B. Question paper format

### C. Marking scheme

Read the instructions printed on the back page of this booklet.

Name of the candidate

UID Number

--	--	--	--	--	--	--	--

I have read all the instructions and shall abide by them.

.....  
Signature of the Candidate

I have verified all the information filled in by the candidate.

.....  
Signature of the invigilator

### USEFUL DATA

Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40 , Mo = 96, g = 10 m/s<sup>2</sup>

**PART I : PHYSICS**

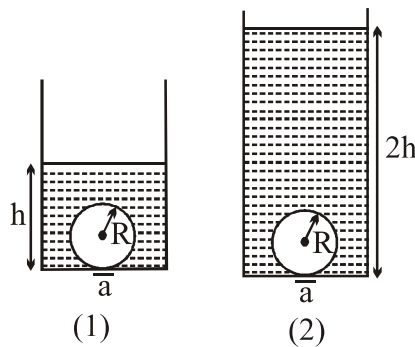
**SECTION - I**

**Single Correct Choice Type**

This section contains **14** multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

---

1. The correct set of diamagnetic substances among the following sets are  
(A) Aluminium, sodium calcium and oxygen      (B) Bismuth, copper, lead and silicon  
(C) Cobalt, nickel, gadolinium and aluminium      (D) Silver, niobium, magnesium and calcium
2. Two springs have force constant  $k_A$  and  $k_B$  such that  $k_B = 2k_A$ . The four ends of the springs are stretched by the same force. If energy stored in spring A is E, then energy stored in spring B is :  
(A)  $\frac{E}{2}$       (B) 2E      (C) E      (D) 4E
3. Two identical cylinders have a hole of radius  $a$  ( $a \ll R$ ) at its bottom. A ball of radius R is kept on the hole and water is filled in the cylinder such that there is no water leakage from bottom. In case-1 water is filled upto height  $h$  and in second case it is filled upto height  $2h$ . If  $F_1$  is force by liquid on sphere in case-1 and  $F_2$  is force by liquid on sphere in case-2 then.



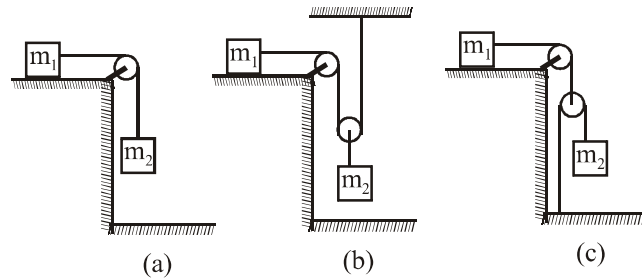
- (A)  $F_1 = F_2 = 0$       (B)  $F_1 > F_2$       (C)  $F_2 > F_1$       (D)  $F_1 = F_2 \neq 0$
- 

**Space For Rough Work**

4. A plano convex lens (refractive indices  $\mu_1$ ) fits exactly into a plano concave lens (refractive indices  $\mu_2$ ). Their plane surfaces are parallel to each other.  $R$  is the radius of curvature of the curved surface of the lenses, then focal length of the combination is

(A)  $\frac{R}{\mu_1 - \mu_2}$       (B)  $\frac{2R}{\mu_2 - \mu_1}$       (C)  $\frac{2R}{2(\mu_1 - \mu_2)}$       (D)  $\frac{R}{2 - (\mu_1 + \mu_2)}$

5. In each of the three arrangements, the block of mass  $m_1$  is being pulled left with constant velocity. There is no friction anywhere. The strings are light and inextensible and pulleys are massless. The ratio of the speed of the block of mass  $m_2$  in the three cases respectively is :



- (A) 2 : 1 : 4      (B) 2 : 4 : 1  
 (C) 4 : 2 : 1      (D) Can not be calculated

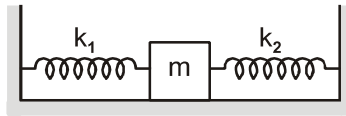
6. An open capillary tube is lowered in a vessel with mercury. The difference between the levels of the mercury in the vessel and in the capillary tube  $\Delta h = 4.6$  mm. What is the radius of curvature of the mercury meniscus in the capillary tube? Surface tension of mercury is 0.46 N/m, density of mercury is 13.6 gm/cc.

(A)  $\frac{1}{340}$  m      (B)  $\frac{1}{680}$  m      (C)  $\frac{1}{1020}$  m      (D) Information insufficient

---

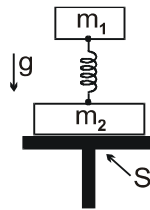
**Space For Rough Work**

7. A block of mass  $m$  is attached to two spring of spring constant  $k_1$  and  $k_2$  as shown in figure. The block is displaced by  $x$  towards right and released. The velocity of the block when it is at its mean position .



- (A)  $\sqrt{\frac{(k_1 + k_2)x^2}{2m}}$       (B)  $\sqrt{\frac{3(k_1 + k_2)x^2}{4m}}$       (C)  $\sqrt{\frac{(k_1 + k_2)x^2}{4m}}$       (D)  $\sqrt{\frac{(k_1 + k_2)x^2}{m}}$

8. The system of two weights with masses  $m_1$  and  $m_2$  are connected with weightless spring as shown. The system is resting on the support S. The support S is quickly removed. The accelerations of each of the weights right after the support S is removed are.

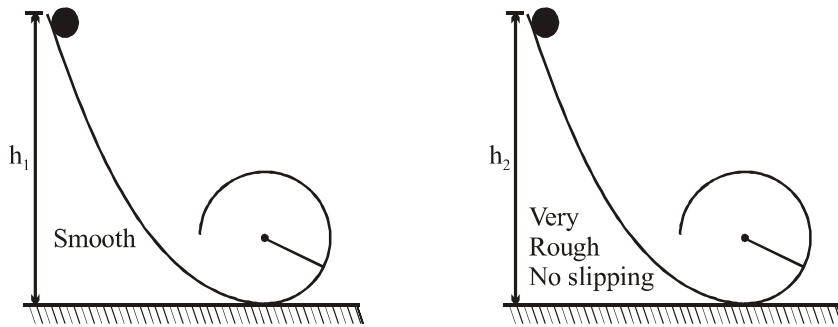


- (A)  $a_1 = 0, a_2 = \frac{(m_1 + m_2)g}{m_2}$       (B)  $a_1 = 0, a_2 = \frac{(m_1 + m_2)g}{m_1}$
- (C)  $a_1 = \frac{(m_1 + m_2)g}{m_1}, a_2 = 0$       (D)  $a_1 = 0, a_2 = 0$

---

**Space For Rough Work**

9. The following figure shows two situations in which a uniform round rigid body is released from rest from the positions shown, such that it is just able to loop the loop without leaving contact with the track. Assuming that radius of the track is large in comparison to the radius of round body, the ratio  $h_1 / h_2$ .



- (A) must be greater than 1  
 (B) must be less than 1  
 (C) must be equal to 1  
 (D) can be greater than or less than 1, depending on the moment of inertia of the round body.
10. A conducting soap bubble having a radius  $a$ , thickness  $t$  ( $t \ll a$ ) is charged to a potential  $V$ . If now, the bubble collapses and forms a droplet, then the potential of the droplet is
- (A)  $V_{\text{droplet}} = V \left[ \frac{a}{3t} \right]^{\frac{1}{3}}$     (B)  $V_{\text{droplet}} = V \left[ \frac{a}{t} \right]^{\frac{1}{3}}$     (C)  $V_{\text{droplet}} = V \left[ \frac{3a}{t} \right]^{\frac{1}{3}}$     (D)  $V_{\text{droplet}} = V \left[ \frac{3a}{4t} \right]^{\frac{1}{3}}$
11. The energy of a photon is  $E$  which is equal to the kinetic energy of a proton. If  $\lambda_1$  be the de-Broglie wavelength of the proton and  $\lambda_2$  be the wavelength of the photon, then photon, then the ratio  $\frac{\lambda_1}{\lambda_2}$  is proportional to
- (A)  $E^0$                       (B)  $E^{1/2}$                       (C)  $E^{-1}$                       (D)  $E^{-2}$

---

**Space For Rough Work**

12. Which of the following set of characteristics of a material is suitable for using it as a dielectric in a capacitor?
- (A) Large dielectric constant and high dielectric strength
  - (B) Large dielectric constant and low dielectric strength
  - (C) Small dielectric constant and high dielectric strength
  - (D) Small dielectric constant and low dielectric strength
13. A monoatomic gas of molar mass  $M_0$  is filled into an insulated container which is moving along a horizontal surface with velocity  $v$ . If the container is stopped suddenly, then the change in temperature of the gas is
- (A)  $\frac{M_0 v^2}{2R}$                       (B)  $\frac{M_0 v^2}{3R}$                       (C)  $\frac{2M_0 v^2}{3R}$                       (D)  $\frac{3M_0 v^2}{2R}$
14. A conducting ring of radius  $r$  and resistance  $R$  is placed in a region of uniform time varying magnetic field  $B$  which is perpendicular to the plane of the ring. If the magnetic field is changing at a rate  $\alpha$ , then the current induced in the ring is
- (A)  $\frac{\pi r^2 \alpha}{2R}$                       (B)  $\frac{2\pi r \alpha}{R}$                       (C)  $\frac{\pi r \alpha}{R}$                       (D)  $\frac{\pi r^2 \alpha}{R}$

---

**Space For Rough Work**

## SECTION - II

### Numerical Answer Type

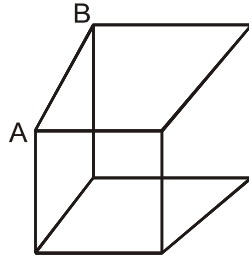
This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than **two decimal** places, **truncate/round-off** the value to **TWO** decimal places. The answer to each of the questions is a **Two decimal** integer, ranging from 00.00 to 99.99. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y, Z and W (say) are 11, 7, 11.25 and 1.2, respectively, then the correct darkening of bubbles will look like the following. **Way 11.00, 07.00, 11.25, 01.20**

X	Y	Z	W
<input type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0	<input type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input type="radio"/> 0	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input checked="" type="radio"/> 0
<input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input type="radio"/> 1 <input type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1
<input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2
<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3
<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4
<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input checked="" type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5
<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6
<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input checked="" type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7
<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8
<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9

15. Two simple pendulums of length 5 m and 20 m are given small displacements in the same direction at the same time. Find the minimum number of oscillations, the shorter pendulum has completed, when the phase difference between them becomes zero again
16. Two particles are projected vertically upwards from the surface of the earth with velocities  $v_1 = \sqrt{\frac{2gR}{3}}$  and  $v_2 = \sqrt{\frac{4gR}{3}}$  respectively. If the maximum heights attained by the two particles are  $h_1$  and  $h_2$  respectively, then calculate the ratio  $\frac{h_1}{h_2}$ .

**Space For Rough Work**

17. In the above arrangement, each side of the cube have the same resistance and it is known that the effective resistance between A and B is  $\frac{5}{9}\Omega$ . Now, if the resistor between A and B is removed, then find the new effective resistance (in  $\Omega$ ) between the same two points.



18. What is the percentage error in the physical quantity A if it is related to four other physical quantities a, b, c and d as  $A = \frac{a^2 b^3}{d\sqrt{c}}$ . The percentage error in measurement of a, b, c and d are 1%, 3%, 2% and 1% respectively.

---

**Space For Rough Work**



19. An ac source of 50 V (r.m.s value) is connected across a series R – C circuit. If the r.m.s voltage across the resistor is 40V, find then the r.m.s voltage across the capacitor (in volt)
20. A particle of mass 0.01 kg travels along a space curve with velocity given by  $(4\hat{i} + 16\hat{k})\text{ms}^{-1}$ . After sometime, its velocity becoems  $(8\hat{i} + 20\hat{j})\text{ms}^{-1}$  due to the action of a conservative force. Then find the work done on the particle during this interval of time (in Joule)

---

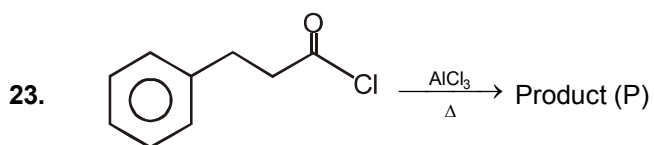
### Space For Rough Work

**PART II : CHEMISTRY**  
**SECTION - I**  
**Single Correct Choice Type**

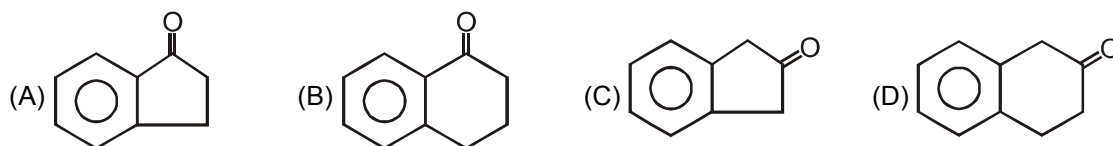
This section contains **14** multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

---

21. Which of the following pair has same value of magnetic moment (spin only)?  
(A)  $\text{FeCl}_2$  and  $\text{CuCl}_2$  (B)  $\text{VOCl}_2$  and  $\text{CuCl}_2$   
(C)  $\text{VOCl}_2$  and  $\text{FeCl}_2$  (D)  $\text{FeCl}_2$  and  $\text{MnCl}_2$
22. For the silver-zinc button cell, net reaction is  
 $\text{Zn(s)} + \text{Ag}_2\text{O(s)} \longrightarrow \text{ZnO(s)} + 2\text{Ag(s)}$   
Given :  $(\Delta_f G^\circ)_{\text{Ag}_2\text{O}} = -20 \text{ kJ mol}^{-1}$  ;  $(\Delta_f G^\circ)_{\text{ZnO}} = -320 \text{ kJ mol}^{-1}$   
What is the  $E^\circ$  of button cell?  
(A) 3.10 V (B) 1.55 V (C) 1.1 V (D) 0.775 V



Major product 'P' should be



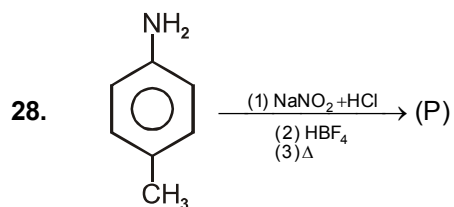
---

**Space For Rough Work**

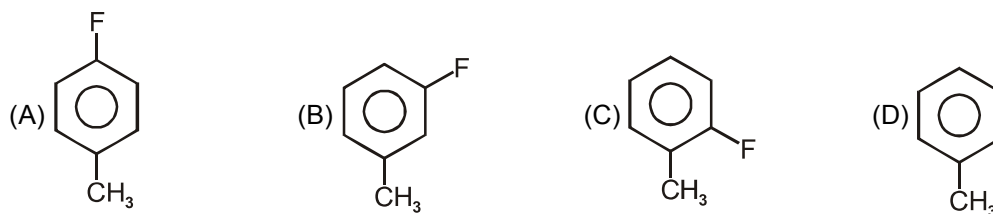
24. Which of the following statement is **incorrect** regarding refining of copper by electrolysis?  
(A)  $\text{CuSO}_4$  15% solution and 5%  $\text{H}_2\text{SO}_4$  solution are used as electrolyte.  
(B) Impure 'Cu' is used as cathode and Pure 'Cu' is used as Anode.  
(C) More electropositive impurities like Fe, Zn, Ni etc dissolved in electrolyte solution.  
(D) Less electropositive metals such as Ag, Au and Pt are collected below anode called anode mud.
25. Total number of hydrogen atoms in one litre of water is :  
(A)  $55.55 \times N_A$                       (B)  $55.55 \times 2 \times N_A$   
(C) 55.55                                (D)  $55.55 \times 3 \times N_A$
26. Which of the following compound gives positive Iodoform Test ?  
(A) 3-Hexanone                      (B) 2-Hexanone                      (C) Hexanal                              (D) 1-Butanol
27. Which of the following is more stable ?  
(A)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$                       (B)  $[\text{FeF}_6]^{3-}$                               (C)  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$                       (D)  $[\text{FeCl}_6]^{3-}$

---

**Space For Rough Work**



Product 'P' should be



29. What is the largest wavenumber in the Pfund series of  $\text{He}^+$  ion?

- (A)  $\frac{25}{R}$  (B)  $\frac{4}{R}$  (C)  $\frac{4R}{25}$  (D) None of these

30. Which of the following oxy acid of phosphorous is a reducing agent and monobasic ?

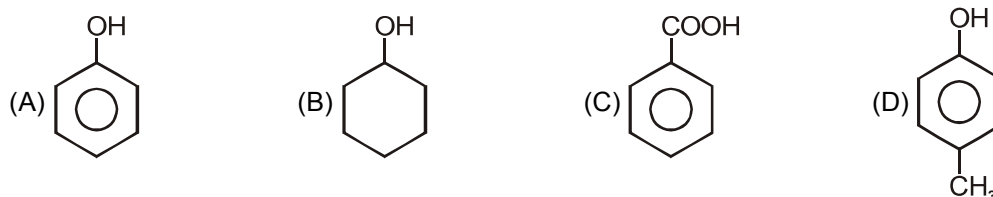
- (A)  $\text{H}_3\text{PO}_2$  (B)  $\text{H}_3\text{PO}_3$  (C)  $\text{H}_3\text{PO}_4$  (D)  $\text{H}_4\text{P}_2\text{O}_6$

---

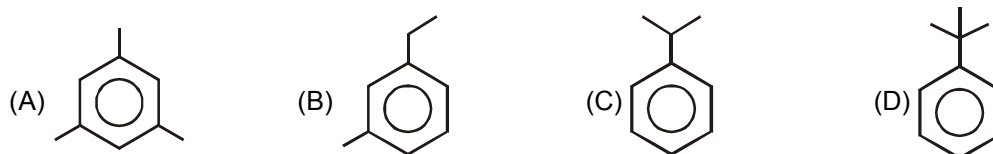
**Space For Rough Work**

31. In which of the following chemical species all bond length are equal ?  
(A)  $\text{IO}_6^{5-}$  (B)  $\text{BrF}_3$  (C)  $\text{SF}_4$  (D)  $\text{IF}_7$

32. Which of the compound react with  $\text{NaHCO}_3$  to give  $\text{CO}_2$



33. Which compound is having more heat of combustion



34. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1 M is 100 ohm. This conductivity of this solution is  $1.29 \text{ Sm}^{-1}$ . Resistance of the same cell filled with 0.02 M of the same solution if the electrolyte is 520 ohm. The molar conductivity of 0.02 M solution of electrolyte would be.  
(A)  $124 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$  (B)  $1240 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$   
(C)  $1.24 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$  (D)  $12.4 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$

---

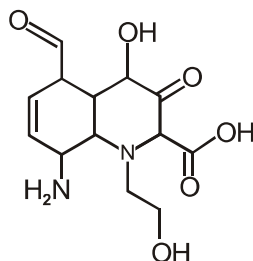
**Space For Rough Work**

**SECTION - II**  
**Numerical Answer Type**

This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than **two decimal** places, **truncate/round-off** the value to **TWO** decimal places. The answer to each of the questions is a **Two decimal** integer, ranging from 00.00 to 99.99. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y, Z and W (say) are 11, 7, 11.25 and 1.2, respectively, then the correct darkening of bubbles will look like the following. **Way 11.00, 07.00, 11.25, 01.20**

X	Y	Z	W
<input type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0	<input type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input type="radio"/> 0	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input checked="" type="radio"/> 0
<input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input type="radio"/> 1 <input type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1	<input type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1
<input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2	<input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2
<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3	<input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3
<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4	<input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4
<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input checked="" type="radio"/> 5	<input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5
<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6	<input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6
<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input checked="" type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7	<input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7
<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8	<input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8
<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9

35. A system absorbed 20 kJ of heat and work done on the surrounding is 10 kJ. The change in internal energy is equal to (in kJ).
36. Find the number of different type of Functional groups



**Space For Rough Work**

37. One mol of non-ideal gas undergoes a change of state (1 atm, 4 L, 100 K) to (3 atm, 6 L, 275 K) with a change in internal energy ( $\Delta U$ ) = 25 L-atm. The change in enthalpy ( $\Delta H$ ) of the process in L-atm.
38. Find out numerical value of expression  $[x \div y]$  for elements : O, F, Br, S and C.  
where ,  $x$  = Number of element(s) having less electron gain enthalpy than chlorine  
 $y$  = Number of element(s) having higher electronegativity than chlorine.

---

**Space For Rough Work**

39. Calculate pH of an aqueous solution of 0.02 M, 2L of  $\text{Ba}(\text{OH})_2$  + 0.02 M, 3L of  $\text{NaOH}$  + 0.02 M, 5L of  $\text{HCl}$  at  $90^\circ\text{C}$  temperature (Given :  $K_w$  at  $90^\circ\text{C} = 10^{-12}$ )
40. pOH of  $10^{-1}$  M  $\text{CH}_3\text{COOH}$  (aq) solution will be (given :  $K_a = 10^{-5}$ )

---

**Space For Rough Work**



**PART III : MATHEMATICS**  
**SECTION - I**

**Single Correct Choice Type**

This section contains **14** multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

---

41. If  $G(x) = -\sqrt{25 - x^2}$  then  $\lim_{x \rightarrow 1} \left( \frac{G(x) - G(1)}{x - 1} \right) =$ :
- (A)  $\frac{1}{\sqrt{24}}$                       (B)  $\frac{1}{5}$                       (C)  $-\sqrt{24}$                       (D) None of these
42. Given  $A = \sin^2\theta + \cos^4\theta$  then for all values of  $\theta$
- (A)  $1 \leq A \leq 2$                       (B)  $\frac{3}{4} \leq A \leq 1$                       (C)  $1 \leq A \leq \frac{13}{6}$                       (D)  $\frac{3}{4} \leq A \leq \frac{13}{6}$
43. The scalar product of  $\vec{A} \cdot ((\vec{B} + \vec{C}) \times (\vec{A} + \vec{B} + \vec{C}))$  equal to :
- (A) 0                      (B)  $[\vec{A}\vec{B}\vec{C}] + [\vec{B}\vec{C}\vec{A}]$                       (C)  $[\vec{A}\vec{B}\vec{C}]$                       (D)  $-[\vec{A}\vec{B}\vec{C}]$
44. The area of the triangle formed by the positive x-axis and the normal and the tangent to the  $x^2 + y^2 = 4$  at  $(1, \sqrt{3})$  is :
- (A)  $\sqrt{3}$                       (B)  $2\sqrt{3}$                       (C)  $3\sqrt{3}$                       (D)  $4\sqrt{3}$
- 

**Space For Rough Work**

45. The function  $f(x) = 2\ln|x| - x|x|$  is increasing on the interval.  
(A)  $(0, 1)$  (B)  $(0, \infty)$  (C)  $(-1, 1)$  (D)  $(-1, 0)$
46. Let  $g(x)$  be a differentiable function on  $\mathbb{R}$  and  $\int_{\sin t}^1 x^2 g(x) dx = (1 - \sin t)$ , where  $t \in \left(0, \frac{\pi}{2}\right)$ . Then the value of  $g\left(\frac{1}{\sqrt{2}}\right)$  equals.  
(A)  $\frac{1}{2}$  (B)  $\frac{1}{\sqrt{2}}$  (C) 2 (D) 1
47. The shortest distance between line  $y - x = 1$  and curve  $x = y^2$ , is :  
(A)  $\frac{3\sqrt{2}}{8}$  (B)  $\frac{8}{3\sqrt{2}}$  (C)  $\frac{4}{\sqrt{3}}$  (D)  $\frac{\sqrt{3}}{4}$
48. Let  $A = \begin{bmatrix} \beta & -1 \\ 1 & 2\beta \end{bmatrix}$  and  $\det.(A^4) = 16$ , then the product of all possible real values of  $\beta$  equals.  
(A)  $\frac{1}{2}$  (B)  $\frac{-1}{2}$  (C) 0 (D) 2

---

**Space For Rough Work**

49. The value of the parameter 'a' such that the area bounded by  $y = a^2x^2 + ax + 1$ , coordinate axes and the line  $x = 1$  attains its least value, is equal to

- (A)  $-\frac{1}{4}$                       (B)  $-\frac{1}{2}$                       (C)  $-\frac{3}{4}$                       (D)  $-1$

50. If  $f(x) = \sin x + \cos x$  and  $g(x) = x^2 - 1$ , then  $g(f(x))$  is invertible in the domain

- (A)  $\left[0, \frac{\pi}{2}\right]$                       (B)  $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$                       (C)  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$                       (D)  $[0, \pi]$

51.  $\int e^x \left( \log_e(3x+2) + \frac{9}{(3x+2)^2} \right) dx$  is :

- (A)  $e^x \left( \log_e(3x+2) - \frac{3}{3x+2} \right) + C$                       (B)  $e^x (\log_e(3x+2)) + C$   
(C)  $e^x \left( \log_e(3x+2) + \frac{1}{3x+2} \right) + C$                       (D)  $e^x \left( \log_e(3x+2) + \frac{3}{3x+2} \right) + C$

---

**Space For Rough Work**

52. The value of  $\int_0^{\frac{\pi}{2}} x \left| \sin^2 x - \frac{1}{2} \right| dx$  is equal to

(A)  $\frac{\pi}{4}$

(B)  $\frac{\pi}{8}$

(C)  $\frac{\pi}{2}$

(D)  $\frac{3\pi}{4}$

53. If  $m$  is a non-zero real number then  $\int \frac{x^{5m-1} + 2x^{4m-1}}{(x^{2m} + x^m + 1)^3} dx$ , is equal to [Note : C denotes constant of integration]

(A)  $\frac{x^{5m} - x^{4m}}{2m(x^{2m} + x^m + 1)} + C$

(B)  $\frac{2m(x^{5m} + x^{4m})}{(x^{2m} + x^m + 1)^2} + C$

(C)  $\frac{x^{4m}}{2m(x^{2m} + x^m + 1)^2} + C$

(D)  $\frac{x^{5m}}{2m(x^{2m} + x^m + 1)^2} + C$

54. If the function  $f(x) = \begin{cases} -x, & x < 1 \\ a + \cos^{-1}(x+b), & 1 \leq x \leq 2 \end{cases}$  is differentiable at  $x = 1$ , then  $\frac{a}{b}$  is equal to

(A)  $\frac{\pi - 2}{2}$

(B)  $\frac{\pi + 2}{2}$

(C)  $\frac{-\pi - 2}{2}$

(D)  $-1 - \cos^{-1}(2)$

---

**Space For Rough Work**

## SECTION - II

### Numerical Answer Type

This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than **two decimal** places, **truncate/round-off** the value to **TWO** decimal places. The answer to each of the questions is a **Two decimal** integer, ranging from 00.00 to 99.99. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y, Z and W (say) are 11, 7, 11.25 and 1.2, respectively, then the correct darkening of bubbles will look like the following. **Way 11.00, 07.00, 11.25, 01.20**

X	Y	Z	W
<input type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8 <input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input checked="" type="radio"/> 0 <input checked="" type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 2 • <input type="radio"/> 2 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8 <input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input type="radio"/> 0 <input checked="" type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input checked="" type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8 <input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9	<input checked="" type="radio"/> 0 <input type="radio"/> 0 • <input type="radio"/> 0 <input checked="" type="radio"/> 0 <input type="radio"/> 1 <input checked="" type="radio"/> 1 • <input type="radio"/> 1 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 2 • <input checked="" type="radio"/> 2 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 3 • <input type="radio"/> 3 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 4 • <input type="radio"/> 4 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 5 • <input type="radio"/> 5 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 6 • <input type="radio"/> 6 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 7 • <input type="radio"/> 7 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 8 • <input type="radio"/> 8 <input type="radio"/> 8 <input type="radio"/> 9 <input type="radio"/> 9 • <input type="radio"/> 9 <input type="radio"/> 9

55. The value of  $\tan\left(\sum_{r=1}^{\infty} \tan^{-1}\left(\frac{4}{4r^2 + 3}\right)\right)$  is equal to

56. If  $\alpha$  and  $\beta$  are roots of the equation  $x^2 - 7x + 1 = 0$ , then value of  $\frac{1}{(\alpha - 7)^2} + \frac{1}{(\beta - 7)^2}$  is

**Space For Rough Work**

57. If  $\lim_{x \rightarrow \infty} \left(1 + \frac{a}{x} - \frac{4}{x^2}\right)^{2x} = e^3$ , then 'a' is equal to : [Note : e denotes Napier's constant]

58. Let a, b and c be any real numbers, Suppose that there are real numbers x, y and z not all zero such that  $x = cy + bz$ ,  $y = az + cx$  and  $z = bx + ay$ , then  $a^2 + b^2 + c^2 + 2abc$  is equal to

---

**Space For Rough Work**

59. If the sum  $\frac{3}{1^2} + \frac{5}{1^2 + 2^2} + \frac{7}{1^2 + 2^2 + 3^2} + \dots +$  up to 20 terms is equal to  $\frac{k}{21}$ , then k is equal to
60. Locus of the point of intersection of the pair of perpendicular tangents to the circles  $x^2 + y^2 = 1$  and  $x^2 + y^2 = 7$  is the director circle of the circle with radius.

---

### Space For Rough Work

Name of the candidate

UID Number

--	--	--	--	--	--	--	--

**B. Question paper format :**

9. The question paper consists of 3 parts (Physics, Chemistry and Mathematics). Each part has **2** sections.
10. **Section I** contains **14** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **only one is correct**.
11. **Section II** contains **06** questions. The answer to each of the questions is a **Number upto Two Decimal**. The answer will have to be appropriately bubbled in the ORS as per the instructions given at the beginning of the section.

**C. Marking Scheme :**

12. For each question in **Section I**, you will be **awarded 4 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In case of bubbling of incorrect answer, **minus one (-1) mark** will be awarded.
13. For each question in **Section-II**, you will be **awarded 4 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In case of bubbling of incorrect answer, **minus one (-1) mark** will be awarded.

---

**ANSWER KEY**

**PART I : PHYSICS**

- |     |       |     |       |     |       |     |       |     |       |     |       |     |   |
|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|---|
| 1.  | B     | 2.  | A     | 3.  | B     | 4.  | A     | 5.  | A     | 6.  | B     | 7.  | D |
| 8.  | A     | 9.  | B     | 10. | A     | 11. | B     | 12. | A     | 13. | B     | 14. | D |
| 15. | 02.00 | 16. | 00.25 | 17. | 01.25 | 18. | 13.00 | 19. | 30.00 | 20. | 00.96 |     |   |

**PART II : CHEMISTRY**

- |     |       |     |       |     |       |     |       |     |       |     |       |     |   |
|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|---|
| 21. | B     | 22. | B     | 23. | A     | 24. | B     | 25. | B     | 26. | B     | 27. | C |
| 28. | A     | 29. | C     | 30. | A     | 31. | A     | 32. | C     | 33. | D     | 34. | A |
| 35. | 10.00 | 36. | 07.00 | 37. | 39.00 | 38. | 02.50 | 39. | 09.60 | 40. | 11.00 |     |   |

**PART III : MATHEMATICS**

- |     |       |     |       |     |       |     |       |     |        |     |       |     |   |
|-----|-------|-----|-------|-----|-------|-----|-------|-----|--------|-----|-------|-----|---|
| 41. | A     | 42. | B     | 43. | A     | 44. | B     | 45. | A      | 46. | C     | 47. | A |
| 48. | B     | 49. | C     | 50. | B     | 51. | A     | 52. | B      | 53. | C     | 54. | B |
| 55. | 02.00 | 56. | 47.00 | 57. | 01.50 | 58. | 01.00 | 59. | 120.00 | 60. | 02.00 |     |   |