



# JEE MAIN DIVISION

# **VIBRANT ACADEMY**

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## **SAMPLE PAPER**

### **SEAT (SCHOLARSHIP CUM EARLY ADMISSION TEST)** **XI TO XII MOVING (RUBY COURSE)**

Time : 1 Hours

Maximum Marks : 200

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

### **INSTRUCTIONS**

#### **A. General :**

1. This booklet is your Question Paper containing **50** questions. The booklet has **24** pages.
2. The **question paper CODE** is printed on the right hand top corner of this sheet and on the back page (page no. **24**) 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 (page no. **24**) 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**

Read the instructions printed on the back page

#### **C. Marking scheme**

(page no. **24**) of this booklet.

Name of the candidate

UID Number

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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

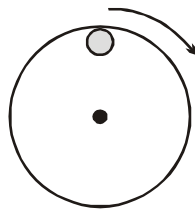
#### **USEFUL DATA**

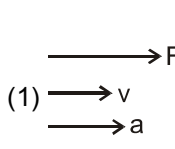
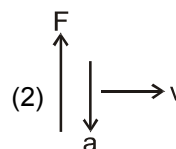
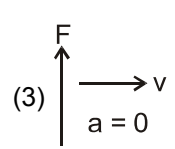
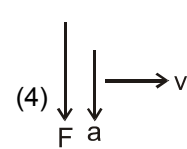
Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40, Mo = 96, g = 10 m/s<sup>2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

**PART I : PHYSICS**  
**Single Correct Choice Type**

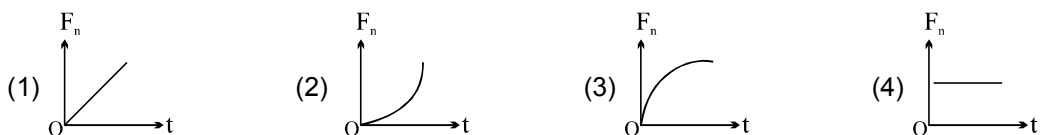
This section contains 15 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

1. A spring has length  $\ell$  and spring constant  $k$ . It is cut into two pieces of length  $\ell_1$  and  $\ell_2$  such that  $\ell_1 = n\ell_2$ . The force constant of spring of length  $\ell_1$  is :  
 (1)  $k(1 + n)$                       (2)  $k(1 + n)/n$                       (3)  $k$                                       (4)  $k/(1 + n)$
2. The definition of average velocity is :  
 (1) the average acceleration multiplied by the time  
 (2) distance travelled divided by the time  
 (3)  $\frac{1}{2}$  (final velocity + initial velocity)  
 (4) displacement divided by the time
3. A small metal cylinder rests on a circular turntable rotating at a constant speed as illustrated in the diagram at the right. Which of the following sets of vectors best describes the velocity, acceleration and net force acting on the cylinder at the point indicated in the diagram?



- (1)       (2)       (3)       (4) 

4. The speed of a particle moving along a circular path is increasing at a constant rate. Identify the correct graph, which shows the variation of centripetal force  $F_n$  with time  $t$  :

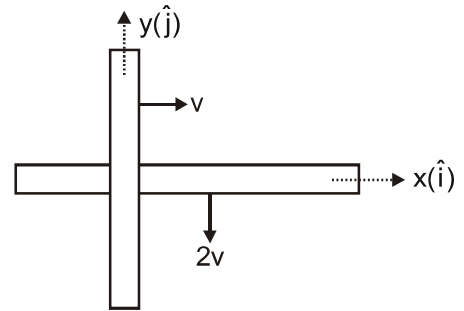


5. A ball is thrown vertically upwards with a velocity 'u' with respect to ground from the balloon descending with constant velocity  $V$ . The ball will pass by the balloon after time :

- (1)  $\frac{u - V}{2g}$                                       (2)  $\frac{u + V}{2g}$   
 (3)  $\frac{2(u - V)}{g}$                                       (4)  $\frac{2(u + V)}{g}$

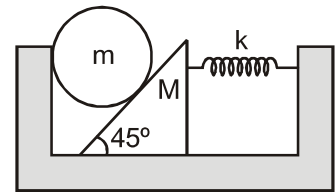
6. Two rods moving perpendicular to each-other along the axis one on the other with velocities  $v$  and  $2v$ , as shown in the figure. The unit vector along which the friction force on the rod moving with velocity  $v$  by the rod moving with velocity  $2v$  will act is :

- (1)  $\frac{1}{\sqrt{5}}(-\hat{i} - 2\hat{j})$       (2)  $\frac{1}{\sqrt{5}}(\hat{i} + 2\hat{j})$   
 (3)  $\frac{1}{\sqrt{5}}(3\hat{i} + 2\hat{j})$       (4)  $\frac{1}{\sqrt{5}}(3\hat{i} - 2\hat{j})$

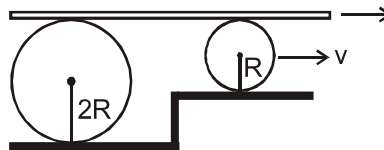


7. All surfaces shown in figure are smooth. System is released with the spring unstretched. In equilibrium, compression in the spring will be :

- (1)  $\frac{2mg}{k}$       (2)  $\frac{(M+m)g}{\sqrt{2}k}$   
 (3)  $\frac{mg}{\sqrt{2}k}$       (4)  $\frac{mg}{k}$

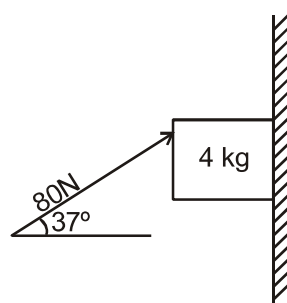


8. Velocity of the centre of smaller cylinder is  $v$ . There is no slipping anywhere. The velocity of the centre of larger cylinder is (darker surface is fixed) :



- (1)  $2v$       (2)  $v$       (3)  $\frac{3v}{2}$       (4) none of these

9. A block of mass 4 kg is pressed against the wall by a force of 80 N as shown in the figure. Determine the value of friction force and block's acceleration (take  $\mu_s = 0.2$ ,  $\mu_k = 0.15$ ) :



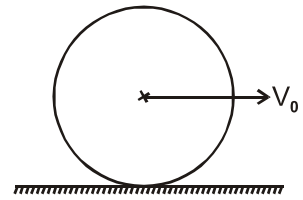
- (1) 8 N, 0 m/s<sup>2</sup>      (2) 32 N, 6 m/s<sup>2</sup>      (3) 8 N, 6 m/s<sup>2</sup>      (4) 32 N, 2 m/s<sup>2</sup>

10. A 2 kg block placed on horizontal rough table which is free to rotate. If block is rotating with table without sliding with angular speed 2 rad/sec at 1 meter distance from centre then find minimum value of coefficient of friction between block and table.

- (1) 0.4      (2) 0.2      (3) 0.8      (4) 1

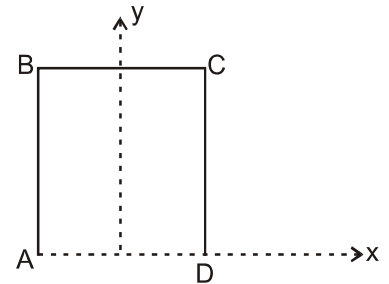
11. A solid sphere is rolling on a stationary horizontal surface with speed of its centre  $V_0$ . Find total kinetic energy of the sphere.

- (1)  $\frac{7}{5}mv^2$                       (2)  $\frac{7}{10}mv^2$   
 (3)  $\frac{3}{7}mv^2$                       (4)  $\frac{3}{10}mv^2$



12. Three rods AB, BC, CD (each of mass  $m$  and length  $\ell$ ) are joined at  $90^\circ$  as shown. Find the coordinates of the centre of mass of this system.

- (1)  $\left(\frac{L}{2}, \frac{L}{2}\right)$                       (2)  $\left(0, \frac{2L}{3}\right)$   
 (3)  $\left(\frac{L}{2}, \frac{2L}{3}\right)$                       (4)  $\left(\frac{L}{2}, \frac{L}{2}\right)$

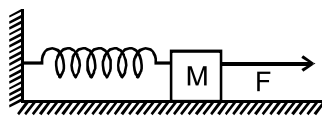


13. The potential energy of a 1 kg particle free to move along the x-axis is given by

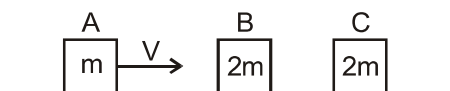
$$V(x) = \left(\frac{x^4}{4} - \frac{x^2}{2}\right) \text{ J}$$

The total mechanical energy of the particle is 2J. Then, the maximum speed (in m/s) is

- (1)  $\frac{3}{\sqrt{2}}$                       (2)  $3\sqrt{2}$                       (3)  $\sqrt{5}$                       (4) None of these
14. Block of mass  $M$  is placed on a smooth horizontal surface. Initially spring is in natural length. A constant horizontal force  $F$  is applied on the block and it is displaced rightwards by  $x$ . The work done by force  $F$  on block is :



- (1)  $Fx + \frac{1}{2}kx^2$                       (2)  $Fx$                       (3)  $\frac{Fx}{2} + \frac{1}{2}kx^2$                       (4)  $\frac{Fx}{2} + kx^2$
15. Three block are placed on smooth horizontal surface. Their masses are  $m, 2m, 2m$  as shown. Block A is given horizontal velocity  $V$ . All collision are elastic what is the final velocity of block C ?



- (1)  $\frac{V}{3}$                       (2)  $\frac{2V}{3}$                       (3)  $\frac{V}{6}$                       (4) None of these

**PART II : CHEMISTRY**  
**Single Correct Choice Type**

This section contains 15 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

16. If the radius of 3<sup>rd</sup> Bohr orbit of H-atom is 476 pm then radius of 4<sup>th</sup> Bohr orbit of H-atom would be :

- (1)  $476 \times \frac{4}{9}$  pm      (2)  $476 \times \frac{3}{4}$  pm      (3)  $476 \times \frac{16}{9}$  pm      (4)  $476 \times \frac{9}{16}$  pm

17. Which of the following compounds will exhibit geometrical isomers.

- (1) 2-butene      (2) 2-butyne      (3) 2-butanol      (4) Butanal

18. Match the list I with list II and select the correct answer :

- | <b>List-I</b> |   |  |  | <b>List-II</b> |
|---------------|---|--|--|----------------|
| (a)           | Most electronegative element                      |  |  | (i) Chlorine   |
| (b)           | The element having highest electron gain enthalpy |  |  | (ii) Hydrogen  |
| (c)           | Most abundant element in the universe             |  |  | (iii) Nitrogen |
| (d)           | Most abundant gas in atmosphere                   |  |  | (iv) Fluorine  |
|               | (a)      (b)      (c)      (d)                    |  |  |                |
| (1)           | i      ii      iii      iv                        |  |  |                |
| (2)           | iv      iii      ii      i                        |  |  |                |
| (3)           | iv      i      ii      iii                        |  |  |                |
| (4)           | ii      iii      iv      i                        |  |  |                |

19. Ratio of wavelengths of series limit lines of bracket and balmer series for an unielectronic species is :

- (1)  $\frac{4}{1}$       (2)  $\frac{9}{4}$       (3)  $\frac{1}{4}$       (4)  $\frac{4}{9}$

20. Which of following has most acidic hydrogen :

- (1) 3-hexanone      (2) 2, 4-Hexanedione  
(3) 2, 5-Hexanedione      (4) 2, 3-hexanedione

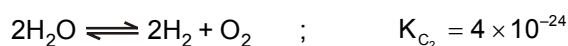
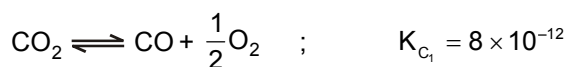
21. An orbital is found to contain total nodes = 3 and radial nodes = 1. Orbital angular momentum for the electron present in this orbital is :

- (1) 0      (2)  $\frac{h}{2\pi} \sqrt{6}$       (3)  $\frac{h}{2\pi} \sqrt{2}$       (4)  $\frac{h}{4\pi} \sqrt{6}$

22. Set of molecular species, which all are planar as well as polar :

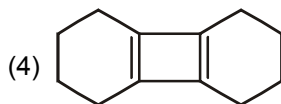
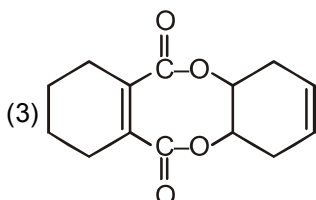
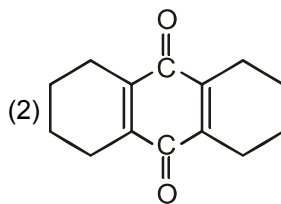
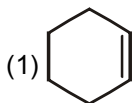
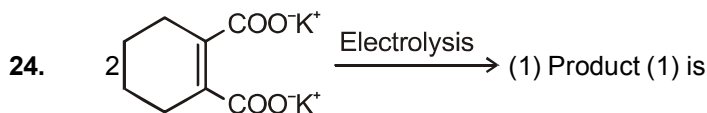
- (1)  $\text{NO}_2^-$ ,  $\text{XeF}_4$ ,  $\text{ICl}_4^-$       (2)  $\text{XeF}_2$ ,  $\text{SF}_2$ ,  $\text{I}_3^-$       (3)  $\text{SnCl}_2$ ,  $\text{I}_3^+$ ,  $\text{NH}_2^-$       (4)  $\text{BF}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{HF}$

23. At 1000°C, equilibrium constants of some reactions are given below :



The equilibrium constant  $K_c$  for the reaction  $\text{CO}_2 + \text{H}_2 \rightleftharpoons \text{CO} + \text{H}_2\text{O}$  at same temperature, is :

- (1) 2      (2) 4      (3) 0.5      (4) 5



25. If distance travelled by a particle of mass 'm' in one second is equal to  $\frac{1}{4}$  th of its de-broglie wavelength ( $\lambda$ )

then which is correct option - (h = plank constant) :

(1)  $\lambda = \sqrt{\frac{h}{m}}$

(2)  $\lambda = \frac{2h}{m}$

(3)  $\lambda = 2\sqrt{\frac{h}{m}}$

(4)  $\lambda = \sqrt{\frac{h}{2m}}$

26. Which element form stable compound with Flourine both in ground state as well as excited state :

(1) Oxygen

(2) Carbon

(3) Boron

(4) Phosphorus

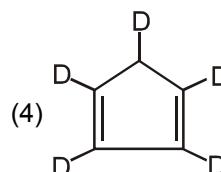
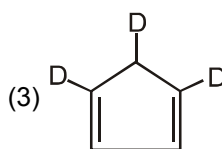
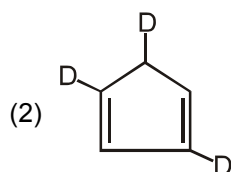
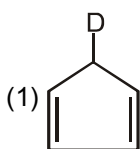
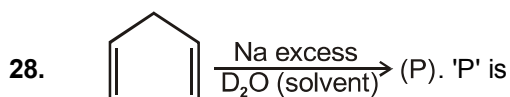
27. If 1 litre of 9.8% w/w  $\text{H}_2\text{SO}_4$  (d = 1.5 g/ml) solution is mixed with 4 litre of 1M KOH solution then pH of resultant solution will be given ( $\log 2 = 0.3$ ,  $\text{H}_2\text{SO}_4$  is strong diprotic acid) :

(1) 0.7

(2) 0.5

(3) 13.3

(4) 10.3



29. Which of the following are wrong prediction regarding a van der Waal's gas? ('a' and 'b' are van der Waal's constant)

(1) A gas with large 'a' has high critical temperature.

(2) A gas with large 'b' is more compressible.

(3) A gas with large 'b' has high critical volume.

(4) A gas with large 'a' is easily liquefiable.

30.  $\text{BF}_3$  does not react with :

(1)  $\text{F}^-$

(2)  $\text{NH}_3$

(3)  $\text{CCl}_4$

(4)  $\text{H}_2\text{O}$

**PART III : MATHEMATICS**  
**Single Correct Choice Type**

This section contains 15 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

31. Let  $\alpha, \beta$  be the roots of  $x^2 - 4x + A = 0$  and  $\gamma, \delta$  be the roots of  $x^2 - 36x + B = 0$ . If  $\alpha, \beta, \gamma, \delta$  form an increasing G.P. and  $A^t = B$  then the value of 't' equals  
(1) 4 (2) 5 (3) 6 (4) 8
32. If a regular polygon of 'n' sides has circum radius = R and inradius = r ; then each side of polygon is :  
(1)  $(R + r) \tan \left( \frac{\pi}{2n} \right)$  (2)  $2(R + r) \tan \left( \frac{\pi}{2n} \right)$   
(3)  $(R + r) \sin \left( \frac{\pi}{2n} \right)$  (4)  $2(R + r) \cot \left( \frac{\pi}{2n} \right)$
33. If  $\alpha$  and  $\beta$  are 2 distinct roots of equation  $a \cos \theta + b \sin \theta = C$  then  $\cos(\alpha + \beta) =$   
(1)  $\frac{2ab}{a^2 + b^2}$  (2)  $\frac{2ab}{a^2 - b^2}$   
(3)  $\frac{a^2 + b^2}{a^2 - b^2}$  (4)  $\frac{a^2 - b^2}{a^2 + b^2}$
34. The straight lines  $3x + y - 4 = 0$ ,  $x + 3y - 4 = 0$  and  $x + y = 0$  form a triangle which is  
(1) equilateral (2) right-angled  
(3) acute-angled and isosceles (4) obtuse-angled and isosceles
35. If  $\cos x + \cos y + \cos z = \sin x + \sin y + \sin z = 0$  then  $\cos (x - y) =$   
(1) 0 (2)  $-\frac{1}{2}$  (3) 2 (4) 1
36. Number of four letter words can be formed using the letters of word **VIBRANT** if letter V is must included, are  
(1) 840 (2) 480 (3) 120 (4) 240
37. The two circles  $x^2 + y^2 - ax = 0$  and  $x^2 + y^2 = c^2$  ( $c > 0$ ) touch each other if  
(1)  $|a| = c$  (2)  $a = 2c$  (3)  $|a| = 2c$  (4)  $2|a| = c$
38. In the interval  $\left[ -\frac{\pi}{2}, \frac{\pi}{2} \right]$ . The equation  $\log_{\sin \theta} \cos 2\theta = 2$  has  
(1) No solution (2) One solution  
(3) Two solution (4) Infinite solution
39. If  $\alpha, \beta$  are the roots of the quadratic equation  $x^2 + px + q = 0$  and  $\gamma, \delta$  are the roots of  $x^2 + px - r = 0$  then  $(\alpha - \gamma)(\alpha - \delta)$  is equal to  
(1)  $q + r$  (2)  $q - r$  (3)  $-(q + r)$  (4)  $-(p + q + r)$

40. The orthocentre of the triangle with vertices  $(5, 0)$ ,  $(0, 0)$ ,  $\left(\frac{5}{2}, \frac{5\sqrt{3}}{2}\right)$  is
- (1)  $(2, 3)$                       (2)  $\left(\frac{5}{2}, \frac{5}{2\sqrt{3}}\right)$                       (3)  $\left(\frac{5}{6}, \frac{5}{2\sqrt{3}}\right)$                       (4)  $\left(\frac{5}{2}, \frac{5}{\sqrt{3}}\right)$
41. If  $a$ ,  $b$  and  $c$  are the roots of the equation  $x^3 + 2x^2 + 1 = 0$ , find  $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ .
- (1) 8                      (2) -8                      (3) 0                      (4) 2
42. The number of ways in which 8 different flowers can be strung to form a garland so that 4 particular flowers are never separated is
- (1)  $4 \cdot 4!$                       (2)  $\frac{8!}{4!}$                       (3) 288                      (4) None of these
43. There are 7 greeting cards, each of a different color and 7 envelopes of the same 7 colors. The number of ways in which the cards can be put in the envelopes, so that exactly 4 of the cards go into the envelopes of the right colors, is
- (1)  ${}^7C_3$                       (2)  $2 \times {}^7C_3$                       (3)  $3! \cdot {}^4C_3$                       (4)  ${}^7C_3 \cdot {}^4C_3$
44. The integral part of  $(7 + 2\sqrt{5})^{2n+1}$  is ( $n \in \mathbb{N}$ )
- (1) an even number                      (2) an even or odd number depending upon  $n$   
(3) an odd number                      (4) None of these
45. A point  $P$  moves such that the sum of its distances from the coordinate axes is equal to the distance from  $P$  to the point  $A(1, 1)$ . The equation of locus of  $P$  in the 1<sup>st</sup> quadrant is
- (1)  $(x + 1)(y + 1) = 1$                       (2)  $(x - 1)(y - 1) = 1$   
(3)  $(x + 1)(y + 1) = 2$                       (4)  $(x - 1)(y - 1) = 2$



## PART IV : MENTAL ABILITY

### Single Correct Choice Type

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

**Directions (Q. 46 to Q. 47) :** In each of the following questions, two statements are given followed by four conclusions numbered I, II, III and IV. You have to take the given statements to be true even if they seem to be at variance from the commonly known facts and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

46. Statements : All politicians are honest.  
All honest are fair.
- Conclusions : I. Some honest are politician.  
II. No honest is politician.  
III. Some fair are politician.  
IV. All fair are politician.
- (1) None follows (2) Only I follows  
(3) Only I and II follow (4) Only I and III follow

47. Statements : Some bottles are drinks.  
All drinks are cups.
- Conclusions : I. Some bottles are cups.  
II. Some cups are drinks.  
III. All drinks are bottles.  
IV. All cups are drinks.
- (1) Only I and II follow (2) Only II and III follow  
(3) Only II and IV follow (4) Only III and IV follow

**Direction (Q. 48) :** In place of ( ) insert the correct sequence of sign, choosing from the alternatives, to make a correct equation.

48.  $40 \ 30 \ 50 \ 20$
- (1) +, =, -, (2) -, =, + (3) =, +, -, (4) +, -, =

**Directions : (Q. 49 to Q. 50)** Find the missing term

49. 
$$\begin{array}{cccccc} 4 & 3 & 8 & 5 & 4 & \\ 3 & 5 & 6 & 12 & 4 & 2 & 4 \\ 1 & 2 & 3 & 4 & ? & 3 & 4 & 5 & 6 \\ 4 & 2 & 1 & 11 & 6 & 2 & 7 \\ 5 & 7 & 9 & 4 & 2 & \end{array}$$
- (1) 10 (2) 13 (3) 14 (4) 16

50. 
$$\begin{array}{cccccc} 4 & 2 & 8 & 4 & 1 & \\ 4 & 3 & 1 & 12 & 2 & 2 & 1 \\ 3 & 1 & 2 & 4 & ? & 1 & 1 & 2 & 2 \\ 2 & 4 & 1 & 16 & 1 & 2 & 4 \\ 1 & 4 & 10 & 5 & 2 & \end{array}$$
- (1) 12 (2) 16 (3) 20 (4) 24

Name of the candidate

UID Number

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**B. Question paper format :**

9. The question paper consists of 4 parts (Physics, Chemistry, Mathematics and Mental).
10. Section-I , II & III in **15** 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-IV in **5** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **only one is correct**.

**C. Marking Scheme :**

12. For each question, 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

1.	2	2.	4	3.	4	4.	2	5.	4	6.	1	7.	4
8.	2	9.	1	10.	1	11.	2	12.	2	13.	1	14.	2
15.	2	16.	3	17.	1	18.	3	19.	1	20.	2	21.	2
22.	3	23.	2	24.	4	25.	3	26.	4	27.	3	28.	4
29.	2	30.	3	31.	2	32.	2	33.	4	34.	4	35.	2
36.	2	37.	1	38.	2	39.	3	40.	2	41.	1	42.	3
43.	2	44.	1	45.	3	46.	4	47.	1	48.	4	49.	3
50.	4												