BRILLIANT TUTORIALS™

ELITE/IIT 2013
PT1/CMP(Advanced)/Qns/9'12

B-MAT PART TEST-I

FOR OUR STUDENTS
TOWARDS

JOINT ENTRANCE EXAMINATION (ADVANCED), 2013

CHEMISTRY – MATHEMATICS – PHYSICS

QUESTION PAPER CODE **1**

Time: 3 Hours **Maximum Marks: 204**

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 60 questions. The booklet has 17 pages.
2. This **question paper CODE** is printed on the right hand top corner of this sheet and on the back page (page no. 17) of this booklet.
3. 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.
4. Fill in the boxes provided below on this page and also write your **Name** and **Enrollment No.** in the space provided on the back page (page no. 17) of this booklet.
5. The answer sheet, a machine-readable Objective Response Sheet **(ORS)**, is provided separately, in which appropriate bubble for each question must be darkened with HB pencil.
6. DO NOT TAMPER WITH/MUTILATE THE ORS OR THE BOOKLET.
7. Do not break the seals of 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 (page no. 17) of this booklet.

C. Marking scheme: Read the instructions on the back page (page no. 17) of this booklet.

SEAL

Name: . _____ **Enrollment No.:** ☐☐☐☐☐☐☐☐☐☐☐☐

SEAL

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

……
Signature of the Candidate

I have verified all the informations filled in by the Candidate.

……
Signature of the Invigilator

DO NOT BREAK THE SEALS ON THIS BOOKLET, AWAIT INSTRUCTIONS FROM THE INVIGILATOR

PART A: CHEMISTRY

SECTION I

Single Correct Answer Type

This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Velocity of electron revolving in the first orbit of hydrogen atom is $2.188\times10^{8}\,cms^{-1}$. The velocity of electron revolving in the first orbit of Li^{2+} ion is

(A) $2.188\times10^{8}\,cms^{-1}$ **(B)** $6.564\times10^{8}\,cms^{-1}$

(C) $7.29\times10^{7}\,cms^{-1}$ **(D)** $4.376\times10^{8}\,cms^{-1}$

2. Average kinetic energy of gaseous molecule is

(A) directly proportional to molecular weight and temperature

(B) directly proportional to temperature but inversely proportional to molecular weight

(C) directly proportional to temperature only

(D) inversely proportional to temperature only

3. 100 ml of 0.1 N hypo decolourised iodine liberated by the addition of x g of crystalline copper sulphate (mol wt 250) to excess of KI solution. The value of x is

(A) 25.0 g **(B)** 5.0 g **(C)** 2.5 g **(D)** 50. 0 g

4. Which of the following has the longest bond length?

(A) NO^{+} **(B)** O_2^{+} **(C)** O_2^{-} **(D)** N_2^{+}

5. A 1M solution of glucose attains dissociation equilibrium

$$6HCHO \rightleftharpoons C_6H_{12}O_6$$

If the equilibrium constant is 6×10^{22}, the conc of HCHO at equilibrium is

(A) 1.6×10^{-6}M **(B)** 1.6×10^{-3} M **(C)** 1.6×10^{-4} M **(D)** 1.6×10^{-8} M

6. For which one of the following reactions combination of high pressure and high temperature favours high yield of products in the equilibrium?

(A) $2\,NF_3(g) \rightleftharpoons N_2(g)+3F_2(g)-54.4$ kcal

(B) $N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)+22.08$ kcal

(C) $C\ell_2(g)+2O_2(g) \rightleftharpoons 2C\ell O_2(g)-49.4$ kcal

(D) $2C\ell_2O_7(g) \rightleftharpoons 2C\ell_2(g)+7O_2(g)+126.8$ kcal

7. Vapour pressures (in mm) of C_6H_6 and C_7H_8 mixture at $50^\circ C$ are given by $P_{Total} = 179\,X_B + 92$ where X_B is the mole fraction of benzene (C_6H_6) in solution. The vapour pressures of pure benzene and pure toluene (C_7H_8) are respectively

(A) 179 mm and 92 mm **(B)** 92 mm and 179 mm

(C) 271 mm and 92 mm **(D)** 92 mm and 271 mm

8. Dissociation constants of monobasic acids A, B, C and D are $6\times10^{-4}, 5\times10^{-5}, 3.6\times10^{-6}$ and 7×10^{-10} respectively. The pH values of their 0.1 molar aqueous solutions are in the order

(A) $A < B < C < D$ **(B)** $A > B > C > D$

(C) $C < B < A < D$ **(D)** $A > C > D > B$

SECTION II

Multiple Correct Answer(s) Type

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

9. Which of the following relations are correct for the equilibrium

$X + Y \rightleftharpoons 3Z$ if α moles of each X and Y per litre are taken initially in the closed container?

(A) $[X] - [Y] = 0$ **(B)** $3[X] + [Z] = 3\alpha$

(C) $[X] - \frac{1}{3}[Y] = \alpha$ **(D)** $[X] + \frac{1}{3}[Y] = \frac{4}{3}[Y]$

10. An acid indicator HIn has $K_a = 3\times10^{-5}$. The acid form is red and basic form is blue. Which of the following statements are correct?

(A) pH=5. when indicator is 75% red

(B) pH=4.05 when indicator is 75% red

(C) pH=5 when indicator is 75% blue

(D) pH=4.05 when indicator is 75% blue

11. Indentify the correct statements.

(A) In XeF_4, Xe is in the state of sp^3d^2 hybridisation

(B) The shape of $PC\ell_4^+$ ion is tetrahedral.

(C) In the molecule, the middle two carbon atoms (*) have sp hybridized orbital

$CH_3 - \overset{*}{C} \equiv \overset{*}{C} - CH_3$

(D) NH_3 has less dipolemoment than NF_3

12. Iso structural pairs are

(A) NF_3, NO_3^- **(B)** I_3^-, N_3^-

(C) NF_3, H_3O^+ **(D)** NO_3^-, BF_3

SECTION III

Comprehension Type

This section contains **2 paragraphs**. Based upon one of the paragraphs **2 multiple choice questions** and based on the other paragraph **2 multiple choice questions** have to be answered. Each of these questions has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 13 and 14

On the basis of kinetic theory of gases, three different kinds of velocities of molecules can be recognized. These are most probable velocity, average velocity and root mean square velocity.

13. The temperature at which r.m.s velocity of SO_2 molecules is half that of helium molecules at 300 K is

(A) 600 K **(B)** 900 K **(C)** 300 K **(D)** 1200 K

14. At certain temperature, average velocity for CH_4 gas molecules is 100 m/sec. This velocity for SO_2 gas molecules at the same temperature will be

(A) 100 m/sec **(B)** 50 m/sec **(C)** 150 m/sec **(D)** 400 m/sec

Paragraph for Question Nos. 15 and 16

The spectrum of atomic hydrogen consists of a number of discrete lines in UV, visible and I.R regions. These are grouped into several series called spectral series. Lyman series appears in U.V Region. Balmer series appears in visible region. Other series appear in IR region. The spectral lines are associated with electronic transitions.

15. The frequency of first line of Balmer series in H-atom is ν_0. The frequency of corresponding line emitted by singly ionized helium $\left(He^+\right)$ ion is

(A) $2\nu_0$ **(B)** $4\nu_0$ **(C)** $\frac{\nu_0}{4}$ **(D)** $\frac{\nu_0}{2}$

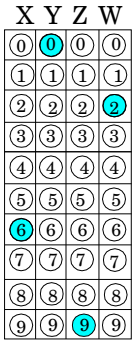
16. If the wavelength of series limit of Lyman series for H-atom is $912\ A^o$, the series limit wavelength of Balmer series of H –atom is

(A) $912\ A^o$ **(B)** $1824\ A^o$ **(C)** $3648\ A^o$ **(D)** $456\ A^o$

SECTION IV

Integer Answer Type

This section contains **4 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. 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 6, 0, 9 and 2, respectively, then the correct darkening of bubbles will look like the following:



17. The number of nodal planes in d_{xy} orbital is _____.

18. Of the following $BeX_2, HgC\ell_2, PC\ell_5, IF_7, C_2H_2, \left[Ag(CN)_2\right]^-$ the number of species having linear shape is _____.

19. The equilibrium constant K_p for the reaction $PC\ell_5 \rightleftharpoons PC\ell_3 + C\ell_2$ is 1.67 atm at $200^\circ C$. The pressure at which $PC\ell_5$ will be 50% dissociated at $200^\circ C$ is _____.atm.

20. The acid dissociation constants of H_2S and HS^- are 10^{-7} and 10^{-13} respectively. The pH of 0.1 M aqueous solution of H_2S will be _____.

PART B: MATHEMATICS

SECTION I

Single Correct Answer Type

This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

21. The equation of the perpendicular bisectors of the sides AB and AC of a Δ ABC are $x - y + 5 = 0$ and $x + 2y = 0$. If $A = (1, -2)$, then the equation of BC is

(A) $14x + 23y - 40 = 0$ **(B)** $14x - 23y + 20 = 0$

(C) $23x - 14y + 40 = 0$ **(D)** $23x + 14y - 20 = 0$

22. If $x\sin^3\theta + y\cos^3\theta = \cos\theta\sin\theta$ and $\tan\theta = \frac{y}{x}$, then

(A) $x^2 + y^2 = 2$ **(B)** $x^2 + y^2 = 4$ **(C)** $x^2 + y^2 = 3$ **(D)** $x^2 + y^2 = 1$

23. If in a Δ ABC, $\sin A \sin B \sin C = p$ and $\cos A \cos B \cos C = q$, then the cubic equation having tan A, tan B, tan C as roots is

(A) $qx^3 + px^2 + qx + p = 0$ **(B)** $qx^3 - px^2 + qx - p = 0$

(C) $qx^3 + px^2 + (q+1)x + p = 0$ **(D)** $qx^3 - px^2 + (q+1)x - p = 0$

24. If $\alpha, \beta, \gamma \in \left(\frac{\pi}{20}, \frac{\pi}{10}\right)$ then the value of $\frac{\sin(\alpha+\beta+\gamma)}{\sin\alpha + \sin\beta + \sin\gamma}$ is

(A) < 1 **(B)** > 1 **(C)** $= 1$ **(D)** $< \frac{1}{3}$

25. The expression $\left(1 + \tan x + \tan^2 x\right)\left(1 - \cot x + \cot^2 x\right)$ is greater than 3, when $x \in$

(A) $\left[0, \frac{\pi}{2}\right]$

(B) $[0, \pi]$

(C) for all x when tan x and cot x are defined

(D) for positive x only

26. The equation $\sin^4 x - 2\cos^2 x + a^2 = 0$ has a real solution if

(A) $-\sqrt{3} \le a \le \sqrt{3}$ **(B)** $-\sqrt{2} \le a \le \sqrt{2}$

(C) $-1 \le a \le 1$ **(D)** $-2 \le a < 2$

27. Let a_1, a_2, a_3 ..... be in harmonic progression with $a_1 = 5$ and $a_{20} = 25$. The least positive integer n for which $a_n < 0$ is

(A) 22 **(B)** 23 **(C)** 24 **(D)** 25

28. AD, BE, CF are the internal bisectors of the angles of a triangle ABC.

Then $\frac{\cos A/2}{AD} + \frac{\cos B/2}{BE} + \frac{\cos C/2}{CF} =$

(A) $\frac{abc}{2s}$ **(B)** $\frac{2s}{abc}$ **(C)** $\frac{ab+bc+ca}{abc}$ **(D)** $\frac{ab+bc+ca}{2abc}$

SECTION II

Multiple Correct Answer(s) Type

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

29. If $2(\cos x + \cos 2x) + \sin 2x(1 + 2\cos x) = \sin x$, then the value of x between $-\pi$ and $+\pi$ is

(A) $\pm\pi$ **(B)** $\pm\frac{\pi}{3}$ **(C)** $-\pi$ **(D)** $-\frac{\pi}{2}$

30. If the point $(\sin\alpha, \cos\alpha)$ does not lie outside the parabola $2y^2 + x - 2 = 0$ then α can belong to

(A) $\left(\frac{\pi}{2}, \frac{5\pi}{6}\right)$ **(B)** $\left(\pi, \frac{3\pi}{2}\right)$ **(C)** $\left(\frac{3\pi}{2}, 2\pi\right)$ **(D)** $\left(0, \frac{\pi}{6}\right)$

31. Let k be real and α, β be the roots of $x^2 + 2kx + 1 = 0$.

Then the value of k for which $\frac{\alpha}{\beta^3} + \frac{\beta}{\alpha^3}$ is least when k =

(A) $\frac{1}{\sqrt{2}}$ **(B)** $-\frac{1}{\sqrt{2}}$ **(C)** $\sqrt{2}$ **(D)** $-\sqrt{2}$

32. AD is the median of ΔABC whose side BC = a. AE and AF are medians of Δ^s ABD and ADC respectively. If $AD = m_1$, $AE = m_2$, $AF = m_3$, then $m_2^2 + m_3^2 - 2m_1^2 =$

(A) $\frac{a^2}{8}$ **(B)** $\frac{a^2}{4}$ **(C)** $\frac{a^2}{2}$ **(D)** a^2

SECTION III

Comprehension Type

This section contains **2 paragraphs**. Based upon one of the paragraphs **2 multiple choice questions** and based on the other paragraph **2 multiple choice questions** have to be answered. Each of these questions has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 33 and 34

For any real θ $\tan^2\theta + \cot^2\theta = \dfrac{8}{1-\cos 4\theta} - 2$

33. The value of $\tan^2\dfrac{\pi}{16} + \tan^2\dfrac{2\pi}{16} + \tan^2\dfrac{3\pi}{16} + \tan^2\dfrac{5\pi}{16} + \tan^2\dfrac{6\pi}{16} + \tan^2\dfrac{7\pi}{16}$ is

(A) 34 **(B)** 32 **(C)** 36 **(D)** none of these

34. The value of $\left(\tan\dfrac{\pi}{12} + \cot\dfrac{\pi}{12}\right)^2$ is

(A) 14 **(B)** 15 **(C)** 16 **(D)** none of these

Paragraph for Question Nos. 35 and 36

Given $x + y = 3 \ldots(1)$ $x^2 - y^2 + 4y = 4. \ldots (2)$. Consider the triangle formed by (1) and the angle bisectors of the angle between the lines represented by (2).

35. The area of the above triangle is

(A) 1 **(B)** 2 **(C)** $\dfrac{1}{2}$ **(D)** $\dfrac{1}{3}$

36. The equation of the straight line joining the orthocentre, centroid and circum centre of the above triangle is

(A) $x - y + 2 = 0$ **(B)** $x - 2y + 4 = 0$ **(C)** $x - y + 4 = 0$ **(D)** none of these

SECTION IV

Integer Answer Type

This section contains **4 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. 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 6, 0, 9 and 2, respectively, then the correct darkening of bubbles will look like the following:

X	Y	Z	W
0	**0**	0	0
1	1	1	1
2	2	2	**2**
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	**9**	9

37. Tangents parallel to the sides of ΔABC are drawn to the incircle of ΔABC. If x,y,z, are the lengths of the portion of these tangents within the ΔABC then $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=$

38. The value of $5+\frac{2}{\pi}\sin^{-1}\left[\cos\left\{\cos^{-1}(\cos x)+\sin^{-1}(\sin x)\right\}\right]$ where $\frac{\pi}{2}<x<\pi$ is equal to

39. If $(1+2x)\left(1+4x^2\right)\left(1+16x^4\right)$ ..... upto n factors $=\sum_{k=0}^{255}2^k x^k$ then n is equal to

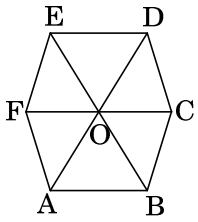
40. If A is the point equidistant from the points (0, 0) (2, 0) and (0, 4) and B is the point at which the family of lines represented by $(4x-y-18)+\mu(2x+y-12)=0$ are concurrent then the length AB is …

PART C: PHYSICS

SECTION I
Single Correct Answer Type

This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

41. Referring to the figure below, which is a regular hexagon ABCDEF, find the value of $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF}$.

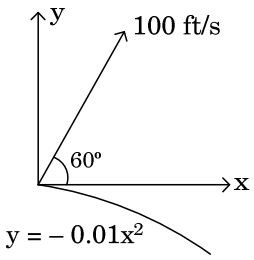


(A) $\overline{AO}$ **(B)** $2\overline{AO}$ **(C)** $4\overline{AO}$ **(D)** $6\overline{AO}$

42. A boy is flying a kite at a height of 30m. If the kite is moving horizontally from the boy at 4 m/s, how fast is the string being paid out, when the kite is 50m from him?

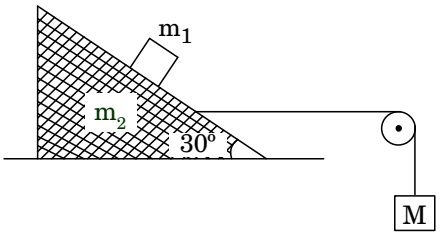
(A) $9.2\,m/s$ **(B)** $8.2\,m/s$ **(C)** $3.2\,m/s$ **(D)** $1.2\,m/s$

43. A projectile is launched at 100 ft/s at 60º above the horizontal. The surface on which it lands is described by the equation $y = -0.001x^2$. Determine the x-coordinate of the point of impact of the projectile on the surface $\left[g = 32\ ft/s^2\right]$.



(A) 321′ **(B)** 432′ **(C)** 502′ **(D)** 602′

44. In figure $m_1 = 1\text{kg}$ and $m_2 = 4\text{kg}$. Find the mass M of the hanging block which will prevent the smaller block from slipping over the triangular block. All the surfaces are frictionless and the strings and pulleys are light.

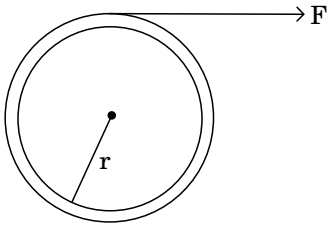


(A) 5.3 kg **(B)** 6.83 kg **(C)** 7.2 kg **(D)** 8.1 kg

45. The wheel as shown in figure is attached to a fixed shaft, and the system is free to rotate without friction. To measure the moment of inertia of the wheel-shaft system, a tape of negligible mass wrapped around the shaft is pulled with a known constant force F. When a length L of tape has unwound, the system is rotating with angular speed ω_0. Find the moment of inertia I of the system.

(A) $\dfrac{2\,FL}{\omega_0^2}$ **(B)** $\dfrac{FL}{\omega_0^2}$

(C) $\dfrac{\sqrt{FL}}{\omega_0}$ **(D)** $\dfrac{2\sqrt{FL}}{\omega_0}$

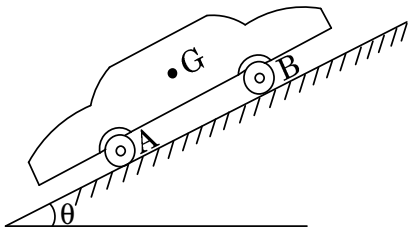


46. A light vertical chain is being used to haul up an object of mass M kg attached to its lower end. The vertical pull has a magnitude at t = 0 and it decreases uniformly at a rate of f newton per metre over a distance h through, which the object is raised. Hence the velocity v of the object after it has been raised through h metre is given by

(A) $\left\{\dfrac{2h}{M}\left(F - mg - f\dfrac{h}{3}\right)\right\}^{1/2}$ **(B)** $\left\{\dfrac{2h}{M}\left(F - mg - f\dfrac{h}{2}\right)\right\}^{1/2}$

(C) $\left\{\dfrac{2h}{M}\left(F - mg + f\dfrac{h}{2}\right)\right\}^{1/2}$ **(D)** $\left\{\dfrac{4h}{M}\left(F - mg - f\dfrac{h}{2}\right)\right\}^{1/2}$

47. A four wheel powered vehicle shown in figure has a mass of 2000 kg with passengers. The roadway is inclined at an angle θ with the horizontal. If the coefficient of static friction between the tyres and the road is 0.3, what is the maximum inclination θ that the car can climb?



(A) $\theta = \tan^{-1}(0.1)$ **(B)** $\theta = \tan^{-1}(0.2)$

(C) $\theta = \tan^{-1}(0.3)$ **(D)** $\theta = \tan^{-1}(0.38)$

48. A train of mass 500×10^3 kg starts from rest and accelerates uniformly to a speed of 90 km/hr in 50 seconds. The total frictional resistance to motion is 15kN. The power required to maintain the speed of 90 km/hr is

(A) 275 kW **(B)** 985 kW **(C)** 7 MW **(D)** 375 kW

SECTION II

Multiple Correct Answer(s) Type

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

49. A dust particle of negligible mass begins to fall and gathers vapour at a constant rate β. If the dust particle falls through a distance of 2.45m

(A) acceleration of the particle is g/2

(B) mass of the particle after 1 second is β

(C) both **(A)** and **(B)** are correct

(D) **(A)** is wrong but **(B)** is correct

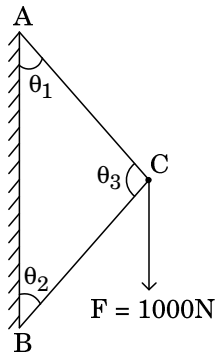
50. Two bars AB and BC are hinged together at C. Other end of the rods are hinged together to a vertical wall at A and B as shown. Then, (given $\sin\theta_1 = 0.64; \sin\theta_2 = 0.78$ and $\sin\theta_3 = 0.99$)

(A) the axial force in the bar BC is 640N

(B) the axial force in the bar AC is 780N

(C) the stress in AC is tensile

(D) the stress in BC is compressive



51. A car moves along a horizontal sine curve $y = a\sin\left(\frac{x}{\alpha}\right)$ where α and a are constants. The coefficient of friction between the wheel and the road is equal to μ. Then

(A) velocity of the car cannot exceed $\alpha\sqrt{\frac{\mu g}{a}}$ for safe riding

(B) radius of curvature at the highest point is $\left(\frac{\alpha^2}{a}\right)$

(C) velocity of the car can exceed $\alpha\sqrt{\frac{\mu g}{a}}$

(D) both (A) and (B) are wrong

52. A pendulum of length 1.00m swings in a vertical plane. Its speed is 5.00 m/s in two horizontal position $\theta = 90^\circ$ and $\theta = 270^\circ$. Then in the two positions

(A) the magnitude of radial acceleration is $25.0\ m/s^2$

(B) the magnitude of tangential acceleration is $19.6\ m/s^2$

(C) the direction of total acceleration is $\tan^{-1}(0.292)$ above the horizontal

(D) the direction of total acceleration is $\tan^{-1}(0.392)$ below the horizontal.

SECTION III

Comprehension Type

This section contains **2 paragraphs**. Based upon one of the paragraphs **2 multiple choice questions** and based on the other paragraph **2 multiple choice questions** have to be answered. Each of these questions has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 53 and 54

A gun kept on a straight horizontal road is used to hit a car travelling along the same road away from the gun with a uniform speed of 72 km/h. The car is at a distance of 500 m from the gun when the gun is fired at an angle of 45° to the horizontal. Then $\left[\text{given } \sqrt{53} = 7.28\right]$

53. The speed of projection of the shell from the gun is

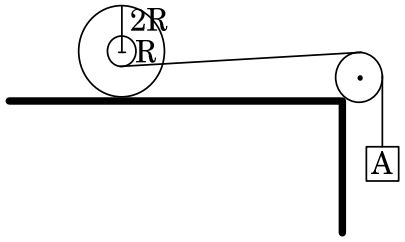
(A) $87\ \text{ms}^{-1}$ **(B)** $67\ \text{ms}^{-1}$ **(C)** $57\ \text{ms}^{-1}$ **(D)** $43\ \text{ms}^{-1}$

54. The distance of the car from the gun when the shell hits it is approximately

(A) 470 m **(B)** 532 m **(C)** 632 m **(D)** 772 m

Paragraph for Question Nos. 55 and 56

A thin massless thread is wound on a reel of mass 3 kg and moment of inertia $0.6\ \text{kg m}^2$. The hub radius R = 10cm and peripheral radius is 2R = 20cm. The reel is placed on a rough table and the friction is enough to prevent slipping. Then



55. Acceleration of the centre of the reel is

(A) $0.37\ \text{m/s}^2$ **(B)** $0.17\ \text{m/s}^2$ **(C)** $0.27\ \text{m/s}^2$ **(D)** $0.11\ \text{m/s}^2$

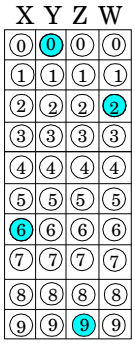
56. Acceleration of the hanging mass of 1kg is

(A) $0.25\ \text{m/s}^2$ **(B)** $0.35\ \text{m/s}^2$ **(C)** $0.14\ \text{m/s}^2$ **(D)** $0.42\ \text{m/s}^2$

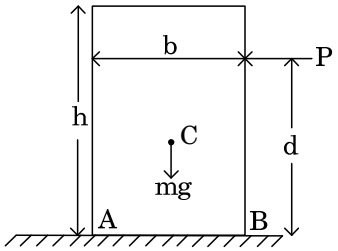
SECTION IV

Integer Answer Type

This section contains **4 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. 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 6, 0, 9 and 2, respectively, then the correct darkening of bubbles will look like the following:

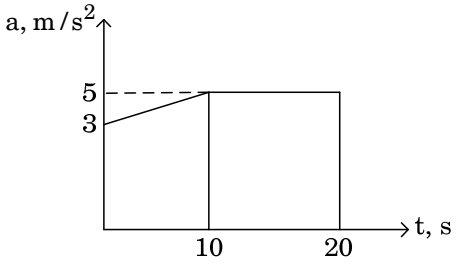


57. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and the floor is μ. The highest position for a horizontal force P that would permit the block to just move without tipping is given by $d = \frac{b}{n\mu}$. What is n?

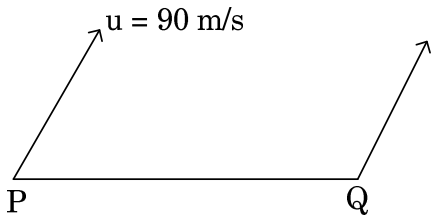


58. A particle is moving with a constant angular acceleration of 4 rad/s^2 in a circular path. At time t = 0, the particle was at rest. The time at which the magnitudes of centripetal acceleration and tangential acceleration are equal is given by $\frac{1}{n}$. What is n?

59. The graph below describes an airplane's acceleration during its take off run. The airplane's velocity when it takes off at t = 20s is given by $v = 10(10n + n)$ what is n?



60. The line joining P and Q is constant and is equal to 10 m. The velocities of P and Q are in directions inclined at angles $\alpha = \cos^{-1}\left(\sqrt{3}/2\right)$ and $\beta = \tan^{-1}\left(\sqrt{3}\right)$ respectively with respect to PQ. If the speed of P is 90 m/s , what is the angular speed of PQ expressed in rad/s?



Name: . ☐ **QUESTION PAPER CODE:** **1**

Enrollment No.: ☐☐☐☐☐☐☐☐☐☐☐☐

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

B. Question paper format

1. The question paper consists of 3 parts (Part A: Chemistry, Part B: Mathematics and Part C: Physics). Each part has 4 sections.
2. **Section I** contains 8 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **only one is correct**.
3. **Section II** contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **one or more is/are correct.**
4. **Section III** of each part contains 2 sets of Comprehension (paragraph) type questions. First set consists of 2 questions and second set has 2 questions, based on a paragraph. Each question has 4 choices (A), (B), (C) and (D), out of which **only one Choice is correct**.
5. **Section IV** contains 4 questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. 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

1. For each question in **Section I**, you will be **awarded 3 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.
2. For each question in **Section II**, you will be **awarded 4 marks** if you darken the bubble(s) corresponding to the correct choice(s) for the answer, and **zero mark** if no bubble is darkened. There is **no negative marking** for incorrect answer(s) for this section.
3. For each question in **Section III**, you will be **awarded 3 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In all other cases, **minus one (–1) mark** will be awarded.
4. For each question in **Section IV**, you will be **awarded 4 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. There is **no negative marking** for incorrect answer in this section.