VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Booster Test - 3 | 2024

Date: 13/10/2022 **Maximum Marks: 177**

Timing: 04:00 PM - 07:00 PM **Duration: 3.0 Hrs**

General Instructions

1. The question paper consists of 3 Subjects (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each Subject has **two** sections (Section 1 & Section 2).

2. **Section 1** contains **3 types** of questions **[Type A, Type B and Type C].**

   Type A contains **Five (05) Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

   Type B contains **Five (05) Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

   Type C contains **ONE (01) paragraph**. Based on the paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

3. **Section 2** contains **6 Numerical Value Type Questions**. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

4. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

Syllabus

Physics: Motion in Two Dimensions, Dynamics of a Particle

Chemistry: Periodic Classification, Chemical Bonding

Mathematics: Trigonometry, Sequence and Series

MARKING SCHEME

SECTION-1 | Type A

- This section contains **Five (05)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : –1 In all other cases.

SECTION-1 | Type B

- This section contains **Five (05)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
  Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
  Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
  Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
  Zero Marks : 0 If unanswered;
  Negative Marks : –2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then
  choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (D) will get +2 marks;
  choosing ONLY (A) will get +1 mark;
  choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
  choosing any other option(s) will get –2 marks.

SECTION-1 | Type C

- This section contains **ONE paragraphs**. Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme;

  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : –1 In all other cases.

SECTION - 2

- This section contains **6 Integer Type Questions**. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)
- Answer to each question will be evaluated according to the following marking scheme:

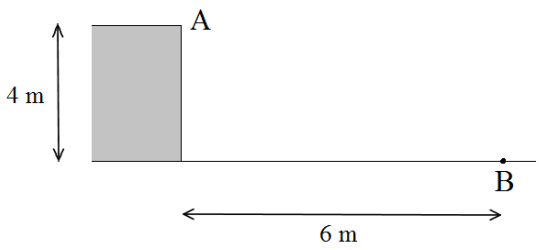
  Full Marks: +3 If ONLY the correct Integer value is entered. There is **NO negative marking.**
  Zero Marks: 0 In all other cases.

SUBJECT I : PHYSICS — 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

1. A boy wants to throw a ball at velocity 6 m/s from the edge A of a building of height 4 m, such that the ball lands at the point B on the horizontal ground, shown in the figure. The two angles at which the boy may throw the ball are: $\left(g = 10\ \text{m/s}^2\right)$



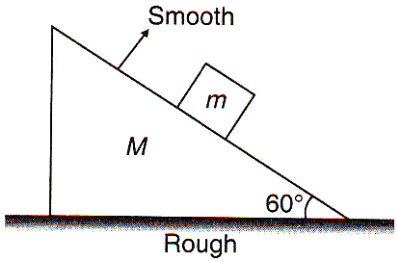
(A) $\tan^{-1}\left(\frac{1}{5}\right)$ and 45° above the horizontal

(B) $\tan^{-1}(2)$ above the horizontal, and $\tan^{-1}\left(\frac{1}{2}\right)$ below the horizontal

(C) $\tan^{-1}\left(\frac{1}{2}\right)$ above the horizontal, and 45° below the horizontal

(D) $\tan^{-1}\left(\frac{1}{5}\right)$ and $\tan^{-1}(2)$ below the horizontal

2. In the diagram shown in figure, wedge of mass M is stationary. Block of mass m = 2 kg is slipping down. Force of friction on the wedge from ground is : (g = 10 m/s^2)



(A) $5\sqrt{3}N$ **(B)** $10N$

(C) $50N$ **(D)** $10\sqrt{3}N$

3. A particle is projected from a horizontal surface at an angle θ with the horizontal.

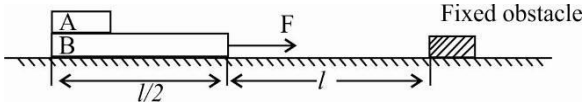
(A) Centre of curvature of projectile's trajectory at the highest point is below the horizontal surface if $\theta < \tan^{-1}\left(\sqrt{2}\right)$

(B) Centre of curvature of projectile's trajectory at the highest point is above the horizontal surface if $\theta < \tan^{-1}\left(\sqrt{2}\right)$

(C) Centre of curvature of projectile's trajectory at the highest point is below the horizontal surface if $\theta > \tan^{-1}\left(\sqrt{2}\right)$

(D) Irrespective of the value of θ center of curvature always lie below the horizontal surface

4. In the figure shown, mass of A and B is equal to M each. Friction between B and lowermost surface is negligible. Initially both the blocks are at rest. The dimension of block A is very small while B has a length of $\ell/2$. A constant force F is applied on the block B and both the blocks starts moving together without any relative motion. After moving through a distance ℓ, the block B encounters a fixed obstacle and comes to rest. Block A slides on block B and just manages to reach the opposite end of block B. What is the coefficient of friction between the two blocks?



(A) F/Mg **(B)** 2F/Mg **(C)** F/2Mg **(D)** Mg/F

5. A particle is moving in a circle of radius *'R'* with resistive tangential acceleration $a_t = \alpha s^2$. Where α is a constant and *s* is the distance covered. If it starts with the speed V_0 what will be the number of revolutions covered by the particle before coming to rest?

(A) $\left(\frac{3V_0^2}{2\pi R\alpha}\right)^{1/3}$ **(B)** $\left(\frac{3V_0^2}{2\pi R\alpha}\right)^{2/3}$ **(C)** $\frac{1}{2\pi R}\left(\frac{3V_0^2}{2\alpha}\right)^{1/3}$ **(D)** $\frac{1}{2\pi R}\left(\frac{3V_0^2}{2\alpha}\right)^{2/3}$

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. A particle initially at rest at the origin starts moving at $t = 0$ with acceleration $a(t) = Pt\,\hat{i} + Q\,\hat{j}$, where *P* and *Q* are positive constants and *t* is time. The particle passes through the point (a, a) at $t = T$. Which of these options is/are correct?

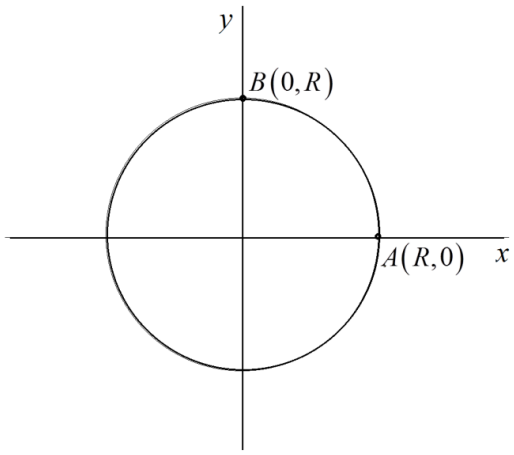
(A) $a = \frac{9Q^3}{2P^2}$

(B) $a = \frac{9Q^3}{4P^2}$

(C) At $t = T$, the angle made by the velocity of the particle with the positive X-axis is $\tan^{-1}\left(\frac{2}{3}\right)$

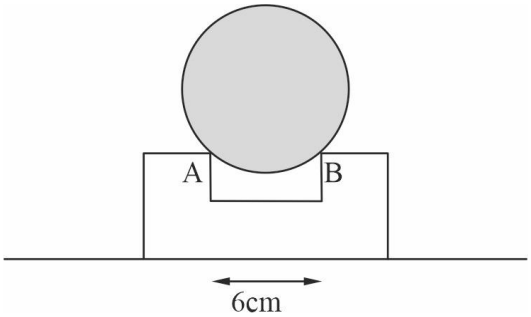
(D) At $t = T$, the angle made by the velocity of the particle with the positive X-axis is $\tan^{-1}\left(\frac{1}{3}\right)$

7. Two particles, A and B, are initially at rest at the points $(R,0)$ and $(0,R)$. Starting at t = 0, the particles move clockwise along the circular path of radius R centred at the origin shown in the figure, with constant speed v and $v/3$ respectively. Let the time instant when the particles meet for the first time be $t = T_1$ and let the time instant when the particles meet for the second time be $t = T_2$. Assume that when the particles meet, they cross without affecting each other. If $T_1 = n\left(\frac{\pi R}{v}\right)$ and $T_2 = m\left(\frac{\pi R}{v}\right)$, then:



(A) $n = 2.25$ **(B)** $n = 0.75$ **(C)** $m = 5.25$ **(D)** $m = 3.75$

8. A metal sphere of radius 5 cm and mass 4 kg is supported by a wooden block at points A and B as shown. The wooden block rests on a horizontal surface. The centre of the sphere and A and B are all in the same vertical plane. A and B are at the same height above the surface, and their horizontal separation is 6 cm. Now, a horizontal force is applied on the block such that the block and sphere both accelerate towards the right at $2\ \text{m/s}^2$. If there is no friction, and the force applied by the block on the sphere at the points A and B is N_A and N_B respectively, then:



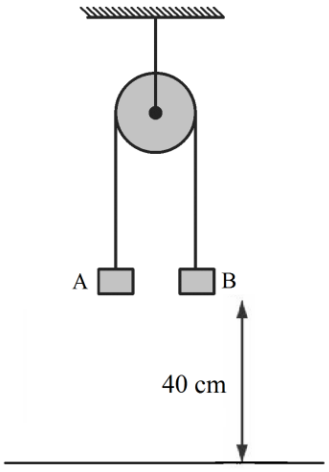
(A) $N_A = 91/3$ Newton

(B) $N_B = 58/3$ Newton

(C) $N_A = 95/3$ Newton

(D) $N_B = 55/3$ Newton

9. Two blocks A and B of mass 1.9 kg and 2.1 kg are suspended using an ideal, massless pulley and string as shown. Initially, both blocks are at a height 40 cm from the ground. The system is released from rest at $t = 0$. At $t = 1.0$ s, the string suddenly breaks at the point it is attached to block B. At $t = 1.1$ s, the velocity of the blocks A and B are v_A and v_B respectively and their height above the ground is h_A and h_B respectively. Which of these options is/are correct? $\left(g = 10\ \text{m/s}^2\right)$



(A) $v_A = 0.5$ m/s, downward

(B) $v_B = 1.5$ m/s, downward

(C) $h_A = 25$ cm

(D) $h_B = 5$ cm

10. A car moving along a circular track of radius 50.0 *m*, accelerates from rest with tangential acceleration 3.00 m/s^2. Consider a situation when the car's centripetal acceleration equals its tangential acceleration, then which of the following is/are true?

(A) The angle around the track does the car travel is 1 rad

(B) The magnitude of the car's total acceleration at that instant is $3\sqrt{2}ms^{-2}$

(C) Time elapsed before this situation is $\sqrt{\frac{50}{3}}s$

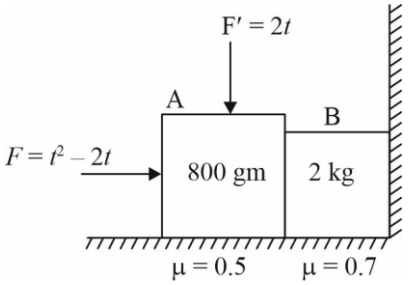
(D) The distance travelled by the car during this time 25 *m*

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

Two bodies A and B are of masses 800 gm and 2kg respectively are kept on a rough floor as shown in figure. Coefficient of friction between block A and floor is 0.5 and between block B and floor is 0.7. Two time varying forces $F = t^2 - 2t$ and $F' = 2t$, (F and F' are in Newton and t in seconds) start acting on the block at $t = 0s$.



11. Block A presses block B just after t =

(A) 2 s **(B)** 3 s **(C)** 4 s **(D)** 6 s

12. Select the incorrect statement.

(A) Friction force on A at $t = 2s$ is 0

(B) Friction force on B at $t = 5$ is 6 *N*

(C) For $t = 0s$ to $t = 4s$ the graph of friction force on *A* versus time will be a parabola

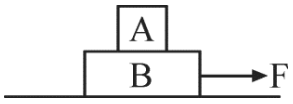
(D) Block *B* presses the wall just after $t = 8s$

SECTION-2

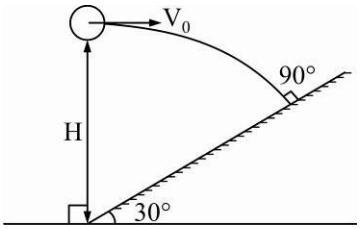
This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. Two particles are projected simultaneously at $t = 0$ from points 24 m apart on the ground, such that the horizontal components of their initial velocities are directed towards each other. At $t = 1.2$ s, they are on the same vertical line, with the separation between them being 6 m. If at $t = 1.2$ s, their relative velocity makes an angle θ with the horizontal, then $\tan\theta$ is equal to _____. $\left(g = 10\ \text{m/s}^2\right)$

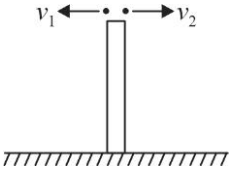
2. Two blocks A and B of masses 1 kg and 2 kg respectively are placed on a horizontal surface as shown. The coefficient of friction between A and B is 0.2 and the coefficient of friction between B and the surface is 0.1. The minimum horizontal force F that must be applied on B such that there is slipping between A and B is _____Newton. $(g = 10\ \text{m/s}^2)$



3. In the given figure the angle of the inclined plane is 30°. Find the horizontal velocity V_0 (in m/s), so that the particle hits the inclined plane perpendicularly. (Given H = 4 m, g = 10 m/s^2)

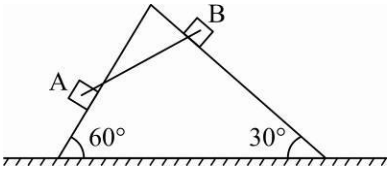


4. Two particles are projected horizontally from the top of a very high tower in opposite direction with speeds v_1 and v_2. Find the separation (in m) between them when their velocities become perpendicular to each other. {v_1 = 1 m/s, v_2 = 4 m/s, $g = 10\ \text{m/s}^2$ }



5. The upper portion of an inclined plane of inclination 45° is smooth and the lower portion is rough. A particle slides down from rest from the top and just comes to rest at the foot. The ratio of smooth length to rough length is 3 : 2. If the coefficient of friction is $n/2$, find n.

6. Two blocks A and B each of mass 1 kg are connected by a string and placed on a fixed wedge as shown in figure. The angle (in degrees) made by the line AB with the horizontal in equilibrium (Assuming no friction) is x. Find x.



SPACE FOR ROUGH WORK

SUBJECT II : CHEMISTRY 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

1. Which of the following process does not involve change in hybridization state of the respective central atoms?

(A) $2IF_5 \longrightarrow IF_4^+ + IF_6^-$ **(B)** $I_2Cl_6 \longrightarrow ICl_2^+ + ICl_4^-$

(C) $CH_3 - CH_3 \longrightarrow CH_3^+ + CH_3^-$ **(D)** $(CH_3)_3N + H^+ \longrightarrow (CH_3)_3NH^+$

2.

	Description		**Element**
I.	Most electronegative element	**P.**	Li
II.	Maximum hydration energy of standard ionic form	**Q.**	Cs
III.	Maximum I.E.	**R.**	F
IV.	Most electropositive element	**S.**	Ne

Codes:

(A) $I \to P, II \to Q, III \to R, IV \to S$ **(B)** $I \to R, II \to Q, III \to P, IV \to S$

(C) $I \to R, II \to P, III \to S, IV \to Q$ **(D)** $I \to Q, II \to R, III \to S, IV \to P$

3. Which of the following statement is NOT true for following species?

ClO_4^- ClO_3^- ClO_2^-

(A) Central chlorine atoms are sp^3 hybrid in all three species

(B) Central chlorine atoms are using one/more d-orbital for π bonds

(C) Average bond order of Cl – O bonds decreases with increase in number of oxygen atoms

(D) All three species are diamagnetic

4. Select correct statement regarding elements Unt and Uub.

(A) Both belongs to same group of the long form of the periodic table

(B) Both belongs to same period of the long form of the periodic table

(C) Both belongs to same block of the long form of the periodic table

(D) Both have equal number of unpaired electrons in their penultimate d-subshells

5. s-Block metals can form their salts with non-metal of group 15^{th}, 16^{th} and 17^{th} but only the members of 17^{th} group are considered as halogens i.e., salt forming elements because:

(A) Salts of the metal with non-metals of 15^{th} and 16^{th} group have lower lattice energy than corresponding salt with non-metal of 17^{th} group and of same period

(B) Salts of the metal with non-metals of 15^{th} and 16^{th} group have higher lattice energy than corresponding salt with non-metal of 17^{th} group and of same period

(C) The formation of anion of non-metal of 15^{th} and 16^{th} group is endothermic while formation of anion of non-metal of 17^{th} group is exothermic

(D) The formation of anion of non-metal of 15^{th} and 16^{th} group is exothermic while formation of anion of non-metal of 17^{th} group is endothermic

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. Select correct orders:

(A) Bond energy : $Cl_2 > F_2$ **(B)** Bond length : $N_2 > O_2$

(C) Bond strength : $CO > O_2$ **(D)** Bond length : $Br_2 > F_2$

7. Xenon on reaction with suitable quantity of O_2F_2 gives a mixture of three non-ionic xenon fluorides (XeF_n) P, Q and R. Compound P has linear geometry while compound Q is polar and non-planar. Select correct statement(s). [Where n < 8]

(A) R is XeF_4

(B) Sum of lone pairs over central atom of molecule P and molecule Q is 3

(C) Central atom of compound Q is sp^3d^2 hybrid

(D) Central atom of compound P is sp^3d hybrid

8. Select incorrect orders of electron affinity:

(A) $1s^2 2s^2 2p^4 > 1s^2 2s^2 2p^5$ **(B)** $1s^2 2s^2 2p^6 3s^2 3p^5 > 1s^2 2s^2 2p^5$

(C) $1s^2 2s^1 > 1s^2 2s^2$ **(D)** $1s^2 2s^2 2p^3 > 1s^2 2s^2 2p^4$

9. Select correct statement/s regarding long form of the periodic table:

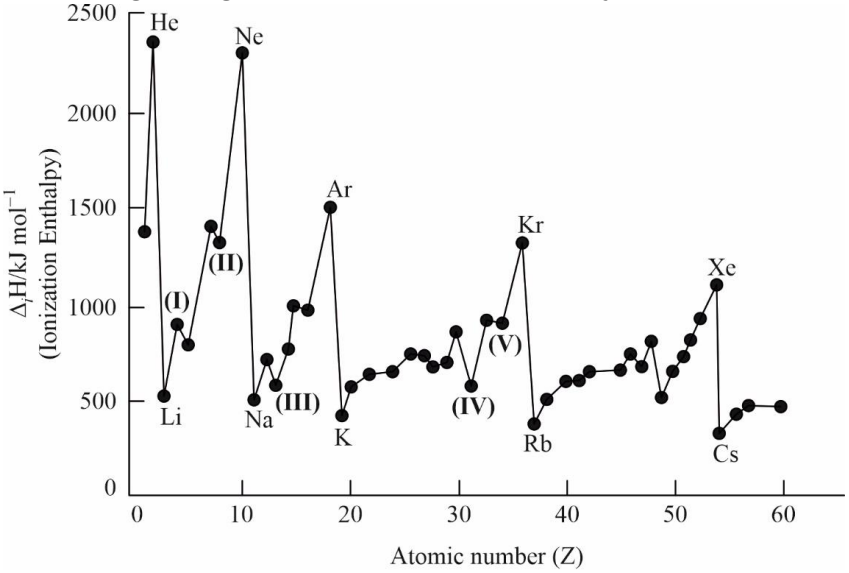
(A) The compounds of the s-block elements, with the exception of those of lithium and beryllium are predominantly ionic

(B) The elements of group 3 to 12 are characterized by the filling of outer d-orbitals by electrons and are referred to as d-block elements

(C) Group 17 elements have very high negative electron gain enthalpies while group 18 elements have large positive electron gain enthalpies

(D) The first member of group has only four valence orbitals available for bonding whereas the second member of the group have nine valence orbitals

10. In reference to the given figure it can be concluded correctly that:



(A) I is "*Be*" and II is "*F*" **(B)** III is "*Al*" and IV is "*Ga*"

(C) II is "*O*" and V is "*Se*" **(D)** I is "*B*" and II is "*Mg*"

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

Strength of intermolecular interactions like dipole-dipole interactions, dipole-induced dipole interactions, instantaneous dipole-induced dipole interactions varies with intermolecular separation (r). Induced dipoles or instantaneous dipoles are overall non-polar molecules or atoms while dipole-dipole interactions occur between permanent dipoles. Properties like boiling point, melting and viscosity depends upon overall strength of such intermolecular interaction.

11. The interaction potential $V_{(r)}$ of intermolecular interaction is generally invertionally proportional to 6^{th} power of the intermolecular separation (r), but it is not true for:

(A) Stationary dipole-dipole interactions

(B) Rotating dipole-dipole interactions

(C) Dipole-induced interactions

(D) Instantaneous dipole-induced dipole interactions

12. Select correct order of boiling point:

(A) $CH_4 > SiH_4 > GeH_4$ **(B)** $F_2 < Cl_2 < Br_2$

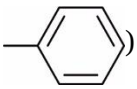
(C) $HCl > HBr > HI$ **(D)** $He > Ne > Ar$

SECTION-2

This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. Number of sp^2 hybrid atoms in the given molecule are _____.

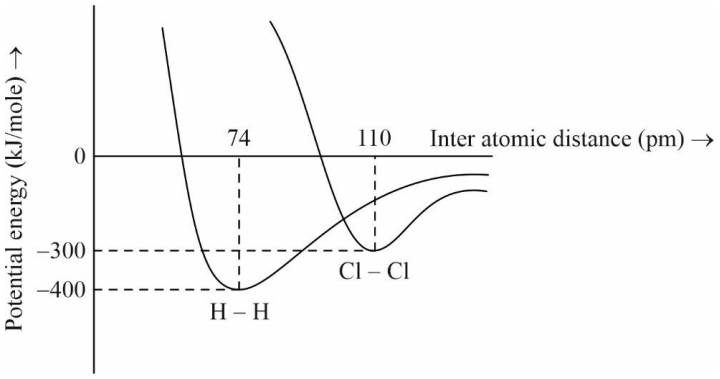
$$CH_3-CH=CH-C\equiv C-\underset{\underset{O}{\|}}{C}-CH=C=CH-ph$$

(Here ph is )

2. Assuming the state of molecules in which presence of lone pair in hybrid orbitals over central atom do not cause change in bond angles, the value of total lone pair-bond pair interactions at 90° formed between electron pairs of the central atoms in given molecules is _____.

ClF_3 BrF_5 XeF_5^-

3.



Above figure represent variation of potential energy during formation of H_2 and Cl_2 molecules by combination of their respective atoms. If difference of electronegativities of Cl and H i.e. $(\chi_{Cl} - \chi_H)$ is given by:

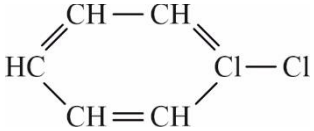
$$\chi_{Cl} - \chi_H = 0.1(\Delta)^{1/2}$$

$$\Delta = E_{H-Cl} - \frac{1}{2}\left[E_{H-H} + E_{Cl-Cl}\right]$$ (E represent bond energy in kJ/mole)

and $\chi_{Cl} = 3.0$, $\chi_H = 2.1$ and bond length $d_{H-H} = 74\,pm$ and $d_{Cl-Cl} = 110\,pm$, then value of $E_{H-Cl}(kJ/mole)$ is _____. [Nearest integer]

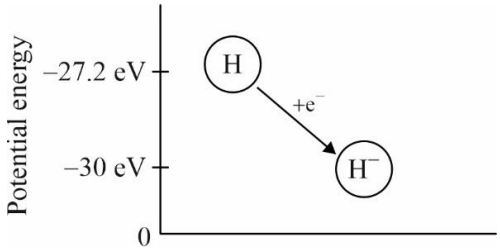
4. Total number of polar molecules out of following is _____.

PCl_3F_2 PCl_2F_3 SO_2 SO_3 CH_3Cl $CHCl_3$



BeF_2 OF_2 BCl_3 NCl_3

5. If a sample of atomic H was exposed to cathode rays at zero Kelvin such that all H atoms got converted to $H^-(g)$. The variation of potential energy during the process is plotted as follows (figure) then value of electron affinity (kJ/mole) of H is _____. [1eV = 96.2 kJ/mol] [Nearest integer]



6. Identify number of correct statements from the following.

1. Atomic radii of Ga is smaller than that of Al

2. In 13th group of periodic table stability of univalent ion increases on moving from up to down

3. Zn, Cd and Hg are d-block elements and do not show most of the properties of transition elements

4. Solubility in water : AgF > AgCl > AgBr > AgI

5. Order of O – O bond length : $H_2O_2 > O_3 > O_2$

6. Order of dipole moment : HF > HCl > HBr > HI

7. Order of dipole moment : $NH_3 > NF_3 > BF_3$

SPACE FOR ROUGH WORK

SUBJECT III : MATHEMATICS 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

1. If $\cos^2\frac{\pi}{8}$ is root of the equation $x^2 + bx + c = 0$ where $b, c \in Q$ then the ordered pair (b, c) is :

(A) $\left(1, \frac{1}{8}\right)$ **(B)** $\left(-1, \frac{1}{8}\right)$ **(C)** $\left(1, -\frac{1}{8}\right)$ **(D)** $\left(-1, -\frac{1}{8}\right)$

2. If $(1-\sin\theta)(1+\sin\theta) = \frac{x^2+y^2+1}{2x}$, then which one is correct? (where x and y are independent and $x, y, \theta \in R$)

(A) $x=1,\ y=0$ **(B)** $x=-1,\ y=0$ **(C)** $x=2,\ y=1$ **(D)** $x=0,\ y=-1$

3. The first term of geometric progression $b_1, b_2, b_3, \ldots$ is unity. The minimum value of $4b_2 + 5b_3$ is :

(A) $-\frac{2}{5}$ **(B)** $-\frac{4}{5}$ **(C)** $-\frac{1}{5}$ **(D)** $-\frac{8}{5}$

4. If $a_1, a_2, \ldots . a_n$ are in AP., then $\frac{\sqrt{a_1}+\sqrt{a_n}}{\sqrt{a_1}+\sqrt{a_2}} + \frac{\sqrt{a_1}+\sqrt{a_n}}{\sqrt{a_2}+\sqrt{a_3}} + \ldots . + \frac{\sqrt{a_1}+\sqrt{a_n}}{\sqrt{a_{n-1}}+\sqrt{a_n}} =$

(A) n **(B)** $n+1$ **(C)** $n-1$ **(D)** $2n$

5. If 10-$A.M.'s$: $a_1, a_2, \ldots .. a_{10}$; 10-$G.M.'s$: $g_1, g_2, \ldots . g_{10}$ and 10-$H.M.'s$ $h_1, h_2 \ldots .. h_{10}$ are inserted between the numbers 2 and 3. Then $\left(\sum_{i=1}^{10} a_i\right)\left(\sum_{i=1}^{10} \frac{1}{h_i}\right) \times \left(g_1.g_2 \ldots .g_{10}\right)^{1/5}$, is equal to :

(A) 25 **(B)** $\frac{625}{3}$ **(C)** 625 **(D)** 525

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. Two consecutive numbers say x_1, x_2 from n natural numbers 1, 2, 3 ……., n are removed. Arithmetic mean of remaining numbers is 26.25, then :

(A) $\frac{n}{x_1+x_2} = \frac{10}{3}$

(B) G.M. of x_1, x_2 is $\sqrt{30}$

(C) Highest power of 2 dividing product of remaining numbers is 44

(D) Highest power of 2 dividing product of remaining numbers is 47

7. If a, b, c are 3 distinct numbers in HP and $a, b, c > 0$, then :

(A) $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in *A.P.*

(B) $\frac{b+c}{a}, \frac{c+a}{b}, \frac{a+b}{c}$ are in *A.P.*

(C) $a^5 + c^5 \geq 2b^5$

(D) $\frac{a-b}{b-c} = \frac{a}{c}$

8. The possible value of $\theta \in (0, \pi)$ such that $\sin\theta + \sin 4\theta + \sin 7\theta = 0$ are $\alpha_1 < \alpha_2 < \alpha_3 ..... < \alpha_n$ then :

(A) $n = 6$ **(B)** $n = 7$ **(C)** $\sum_{i=1}^{n} \alpha_i = \frac{55\pi}{18}$ **(D)** $\sum_{i=1}^{n} \alpha_i = 3\pi$

9. If $A_1, A_2, A_3; G_1, G_2, G_3;$ and H_1, H_2, H_3 are the three arithmetic, geometric and harmonic means between two positive numbers a and b ($a > b$), then which of the following is(are) true ?

(A) $2G_1G_3 = H_2(A_1 + A_3)$ **(B)** $A_2H_2 = G_2^2$

(C) $A_2G_2 = H_2^2$ **(D)** $2G_1A_1 = H_1(A_1 + A_3)$

10. If b is the G.M. between a, c and x, y are the A.Ms of a, b and b, c respectively then which of the following is/are correct:

(A) $\frac{a}{x} + \frac{c}{y} = 2$ **(B)** $\frac{1}{x} + \frac{1}{y} = \frac{3}{b}$ **(C)** $\frac{a}{x} + \frac{c}{y} = 1$ **(D)** $\frac{1}{x} + \frac{1}{y} = \frac{2}{b}$

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

Consider $S_n = \frac{8}{5} + \frac{16}{65} + ...+ \frac{8r}{4r^4 + 1}$.

11. Sum of infinite terms of above series will be :

(A) 0 **(B)** 1/2 **(C)** 2 **(D)** 1

12. The value of S_{16} must be :

(A) $\frac{80}{41}$ **(B)** $\frac{1088}{545}$ **(C)** $\frac{107}{245}$ **(D)** $\frac{207}{245}$

SECTION-2

This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. If the sum of n terms of an A.P. is $cn(n+1)$, where $c \neq 0$. The sum the squares of these terms is $\frac{2}{k}c^2(n)(n+1)(2n+1)$ then the value of k is _____.

2. The value of expression $\frac{\tan 20^\circ + \tan 40^\circ + \tan 80^\circ - \tan 60^\circ}{\sin 40^\circ} =$ _____.

3. Let $f(x) = \sin 3x + \cos x$, $g(x) = \cos 3x + \sin x$, then number of point(s) where the graphs $y = f(x)$ and $y = g(x)$ intersect in $[0, \pi]$ is _____.

4. Number of solution of the equation

$$|\sin x \cos x| + \sqrt{2 + \tan^2 x + \cot^2 x} = \sqrt{3},\ x \in (0, 6\pi) - \left\{n\pi, (2n+1)\frac{\pi}{2}\right\}$$

where $n \in I$, is _____.

5. Let $f(x) = ax^2 + bx + c$ where a, b, c are integers.

If $\sin\frac{\pi}{7} \cdot \sin\frac{3\pi}{7} + \sin\frac{3\pi}{7} \cdot \sin\frac{5\pi}{7} + \sin\frac{5\pi}{7} \cdot \sin\frac{\pi}{7} = f\left(\cos\frac{\pi}{7}\right)$ then the value of $f(2)$ is _____.

6. Let $\sum_{r=1}^{5} \frac{1}{r(r+1)(r+2)(r+3)} = x$ then greater integer less than $54x$ is _____.

SPACE FOR ROUGH WORK

End of Advanced Booster Test - 3 | JEE-2024