FIITJEE

ALL INDIA INTEGRATED TEST SERIES

HALF COURSE TEST – IV

JEE (Main)-2020

TEST DATE: 31-03-2019

Time Allotted: 3 Hours **Maximum Marks: 360**

General Instructions:

- The test consists of total 90 questions.
- Each subject (PCM) has 30 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each part has only one section: **Section-A**.

  Section-A (01 – 30, 31 – 60, 61 – 90) *contains 90 multiple choice questions which have* ***only one correct answer****. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

Physics

PART – I

SECTION – A
(One Options Correct Type)

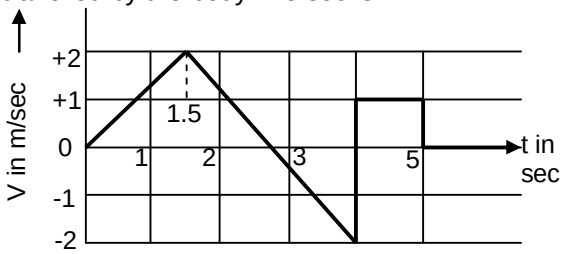
This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

1. Four lengths are measured as 18.425 cm, 7.21 cm, 5.04 cm and 10.3571 cm. Taking significant figures into account, then sum of lengths should be:
   (A) 41.0321 cm
   (B) 41.03 cm
   (C) 41.032 cm
   (D) 41.0 cm

2. The density of a material is 8 g/cc. In a system in which unit of length is 5 cm and unit of mass is 20 g, the density of material is:
   (A) 50
   (B) 40
   (C) 80
   (D) 24

3. Starting from rest a particle moves in a straight line with acceleration
   $a = (25 - t^2)^{1/2} m/s^2$ for $0 \le t \le 5 s$
   $a = \frac{3\pi}{8} m/s^2$ for $t > 5 s$
   The velocity of particle at t = 7 s is:
   (A) 11 m/s
   (B) 22 m/s
   (C) 33 m/s
   (D) 44 m/s

4. The velocity versus time graph of a body moving in a straight line is as follows. The distance travelled by the body in 5 sec is:



   (A) 2 m
   (B) 3 m
   (C) 4 m
   (D) 5 m

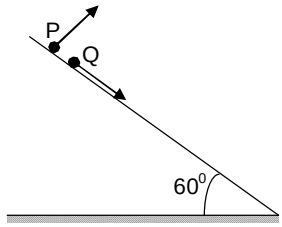
5. Two plane, smooth surfaces are parallel to each other and are initially a distance of 2 meter apart. The two surfaces approach each other with a velocity of 1 cm/sec. A particle starts with a velocity of a 4 cm/sec from one surface and collides normally and elastically on the other surface from the time the two surfaces start moving. The collisions continue back and forth till the surfaces touch each other. The total distance covered by the particle is:
   (A) 2 m
   (B) 1 m

(C) 4 m
(D) 3 m

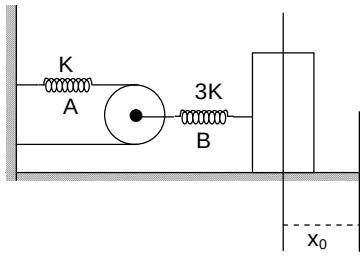
6. A particle's position as a function of time is described as $y(t) = 2t^2 + 3t + 4$. What is the average velocity of the particle from t = 0 to t = 3 sec?
(A) 3 m/sec
(B) 6 m/sec
(C) 9 m/sec
(D) 12 m/sec

7. Rain, pouring down at an angle α with the vertical has a speed of 10 ms^{-1}. A girl runs against the rain with a speed of 8 ms^{-1} and sees that the rain makes an angle β with the vertical, then relation between α and β is:
(A) $\tan\alpha = \frac{8+10\sin\beta}{10\cos\beta}$
(B) $\tan\beta = \frac{8+10\sin\alpha}{10\cos\alpha}$
(C) $\tan\alpha = \tan\beta$
(D) $\tan\alpha = \cot\beta$

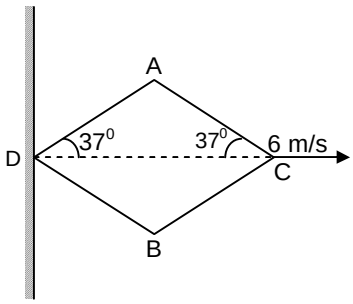
8. A particle P is projected from a point on the surface of smooth inclined plane. Simultaneously another particle Q is released on the smooth inclined plane from the same position. P and Q collide on the inclined plane after t = 4 second. The speed of projection of P is: (Take g = 10 m/s^2)
(A) 5 m/s
(B) 10 m/s
(C) 15 m/s
(D) 20 m/s



9. In the diagram given below initially there is no elongation in spring. If the block is displaced towards right by x_0. Calculate the elongation of spring A.
(A) $\frac{3}{7}x_0$
(B) $\frac{x_0}{4}$
(C) $\frac{x_0}{7}$
(D) $\frac{x_0}{3}$



10. A rhombus ABCD is shown in the figure. The sides of the rhombus can rotate about vertex A, B, C and D. The vertex C is moving with a velocity of 6 m/s in horizontal direction. Determine the velocity of vertex A:
(A) 4.8 m/s
(B) 4.5 m/s
(C) 5 m/s
(D) None of these



11. A block of mass M slides down a rough inclined surface of inclination 'θ' and reaches the bottom at speed 'v'. However, if it slides down a smooth inclined surface of same length and same inclination, it reaches the bottom with speed kv. Coefficient of friction between the block and the rough incline is:

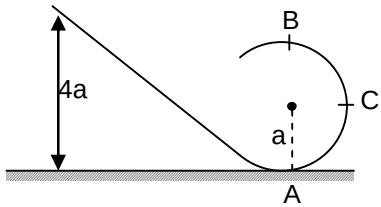
(A) $\sin\theta\left(k^2-1\right)$

(B) $\left(\frac{k^2-1}{k^2}\right)\tan\theta$

(C) $\left(\frac{k^2+1}{k^2}\right)\cos\theta$

(D) $\frac{k^2-1}{k^2}$

12. Figure shows a smooth path, the section ACB of which is part of a vertical circle of radius 'a'. An object of mass 'm' is released from the highest point of path at height '4a'. Resultant force acting on the object when it is at C, is:



(A) $\sqrt{52}$ mg

(B) $\sqrt{47}$ mg

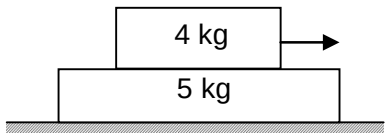
(C) $\sqrt{37}$ mg

(D) $\sqrt{69}$ mg

13. The potential energy of a conservative system is given by $V(x)=(x^2-3x)$ joule, where x is measured in metre. Then, its equilibrium position is at:

(A) 1.5 m
(B) 2 m
(C) 3 m
(D) 0 m

14. A large slab of mass 5 kg lies on a smooth horizontal surface, with a block of mass 4 kg lying on the top of it. The coefficient of friction between the block and the slab is 0.25. if the block is pulled horizontally by a force of F = 6 N, then the work done by the force of friction on the slab, between the instants t = 2s to t = 3s is: ($g = 10\ ms^{-2}$)



(A) 2.4 J
(B) 5.55 J
(C) 4.44 J
(D) 10 J

15. A particle mass m, strikes on ground with angle of incidence 45^0. If coefficient of restitution $e=1/\sqrt{2}$, the velocity of reflection:

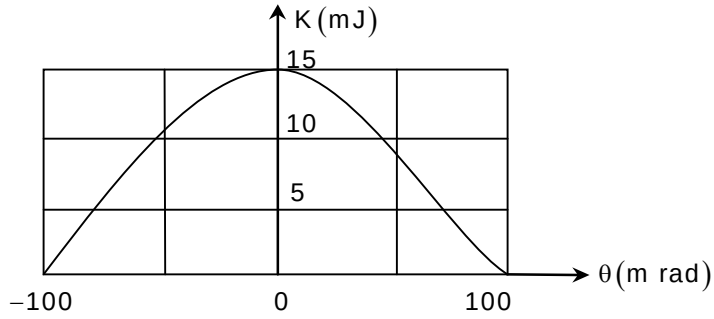
(A) $\frac{\sqrt{3}}{2}v$

(B) $\sqrt{3}v$

(C) $\frac{1}{2}v$

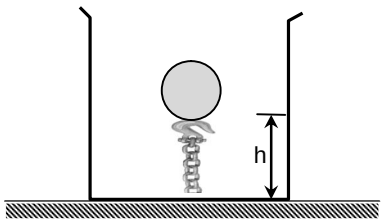
(D) $\frac{v}{\sqrt{3}}$

16. Figure shows the kinetic energy K of a simple pendulum versus its angle θ from the vertical. The pendulum bob has mass 0.2 kg. The length of the pendulum is equal to $\left(g = 10\ m/s^2\right)$



(A) 2.0 m
(B) 1.8 m
(C) 1.5 m
(D) 1.2 m

17. In this case one end of a long iron chain of linear mass density λ is fixed to a sphere of mass m and specific gravity 1/3 while the other end is free. The sphere along with the chain is immersed in a deep lake. If specific gravity of iron is 7, the sphere is slightly displaced vertically from its equilibrium position. The time period of the resulting SHM is



(A) $\frac{4\pi}{7}\sqrt{\frac{46m}{\lambda g}}$

(B) $\frac{2\pi}{3}\sqrt{\frac{35m}{\lambda g}}$

(C) $\frac{2\pi}{3}\sqrt{\frac{35\lambda}{mg}}$

(D) $\frac{4\pi}{7}\sqrt{\frac{46\lambda}{mg}}$

18. A string of length 'ℓ' fixed at both ends vibrates in resonance with a tuning fork of frequency 'f' at two successive values of tension T_1 and T_2 in the string. Find the specific mass (mass per unit length) of the string:

(A) $\frac{T_1T_2}{f^2\ell^2\left(\sqrt{T_1}-\sqrt{T_2}\right)^2}$

(B) $\frac{2T_1T_2}{f^2\ell^2\left(\sqrt{T_1}-\sqrt{T_2}\right)^2}$

(C) $\frac{T_1T_2}{2f^2\ell^2\left(\sqrt{T_1}-\sqrt{T_2}\right)^2}$

(D) None of these

19. A 20 cm long rubber string obeys Hook's law. Initially when it is stretched to make its total length of 24 cm, the lowest frequency of resonance is n_0. It is further stretched to make its total length of 26 cm. The lowest frequency of resonance will now be

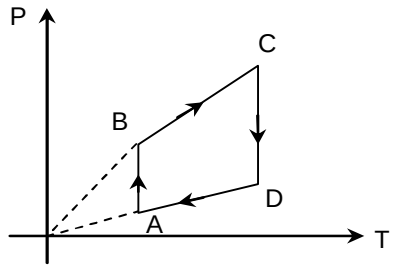
(A) The same as n_0

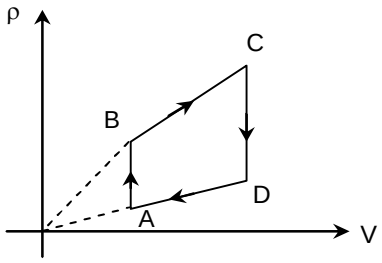
(B) Greater than n_0
(C) Lower than n_0
(D) None of these

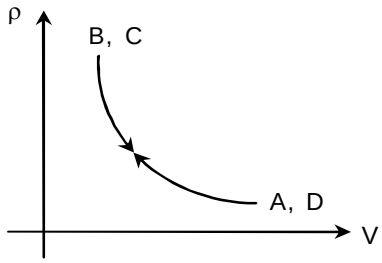
20. A faulty thermometer has its fixed points marked 5^o and 95^o. This thermometer reads the temperature of a body as 59^o. Then correct temperature on Celsius scale is:
(A) 59^o
(B) 48.6^o
(C) 60^o
(D) 58^o

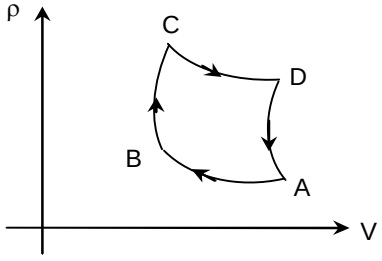
21. An ideal gas undergoes a process in which $T = T_0 + aV^3$, where T_0 and "a" are positive constants and V is molar volume. The volume for which pressure will be minimum is:
(A) $\left(\frac{T_0}{2a}\right)^{1/3}$
(B) $\left(\frac{T_0}{3a}\right)^{1/3}$
(C) $\left(\frac{a}{2T_0}\right)^{2/3}$
(D) $\left(\frac{a}{3T_0}\right)^{2/3}$

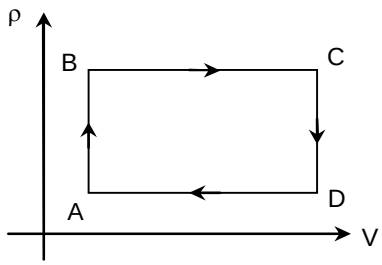
22. Pressure versus temperature graph of an ideal gas is as shown in figure corresponding density (ρ) versus volume (V) graph will be:



(A)


(B)


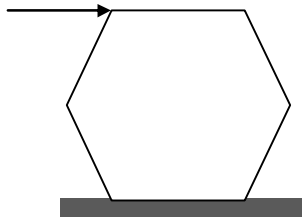
(C)


(D)


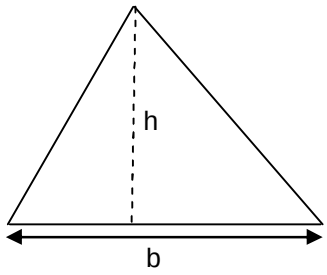
23. The temperature of a liquid drops from 365 K to 361 K in 2 minute. The time during which temperature of the liquid drops from 344 K to 342 K is (Temperature of room is 293 K):
(A) 84 s
(B) 72 s
(C) 66 s
(D) 60 s

24. A tuning fork of frequency 340 Hz is vibrated just above the tube of 120 cm height. Water is poured slowly in the tube. What is the minimum height of water necessary for the resonance (speed of sound in the air = 340 m/sec):
(A) 15 cm
(B) 25 cm
(C) 30 cm
(D) 45 cm

25. For the toppling of the shown Figure regular hexagon. The coefficient of friction must be:
(A) > 0.21
(B) < 0.21
(C) = 0.21
(D) $\leq$ 0.21



26. Moment of inertia of a triangular lamina about its base is (assume M is mass, h is altitude and b is base) :
(A) $\frac{Mb^2}{6}$
(B) $\frac{Mh^2}{6}$
(C) $\frac{M(h^2+b^2)}{6}$
(D) $\frac{Mbh}{6}$

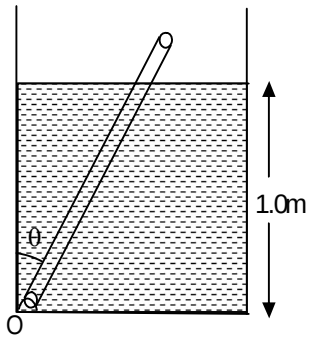


27. The gravitational force in a region is given by $\vec{E} = ayi + axj$. Find the work done by gravitational force to shift a point mass m from (0, 0, 0) to (x_0, y_0, z_0).
(A) $ma\, x_0 y_0 z_0$
(B) $ma\, x_0 y_0$
(C) $-ma\, x_0 y_0$
(D) Zero

28. A non-homogeneous sphere of radius 'a' has the following density variation :
$d = d_0$ when $r \leq a/3$
$d = d_0/2$ when $a/3 < r \leq a$
(r is the distance from the centre of the sphere)
Consider the following statements :
1. Gravitational field at $r = a/2$ is greater than that at $r = 2a$
2. Gravitational field at $r = a/4$ is greater than that at $r = 2a$
Which of the statements given above is correct?
(A) 1 only
(B) 2 only

(C) both 1 and 2
(D) neither 1 nor 2

29. A uniform rod of length 2.0 m, specific gravity 0.5 and mass 2 kg is hinged at one end to the bottom of a tank of water (specific gravity = 1.0) filled upto a height of 1.0 m as shown in the figure. Taking the case $\theta = 0^o$ the force exerted by the hinge on the rod is: $(g = 10\ m/s^2)$



(A) 10.2 N upwards
(B) 4.2 upwards
(C) 8.3 N downwards
(D) 6.2 N upwards

30. Three capillary tubes of same length but internal radii 0.3 mm, 0.45 mm and 0.60 mm are connected in series and a liquid flow steadily through them. If the pressure difference across the third capillary is 8.1 mm of mercury, the pressure difference across the first capillary (in mm of mercury) is:
(A) 16.2
(B) 32.4
(C) 129.6
(D) 2.025

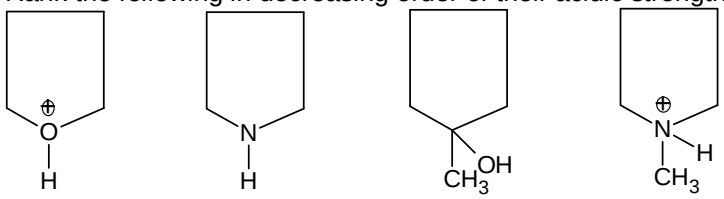
Chemistry

PART – II

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

31. Rank the following in decreasing order of their acidic strengths.

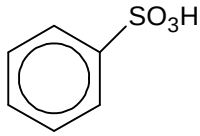


(A) (B) (C) (D)

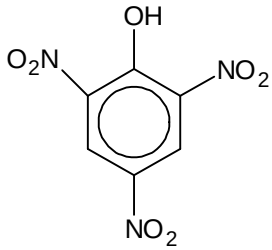
(A) A > C > B > D
(B) A > D > B > C
(C) A > D > C > B
(D) D > A > C > B

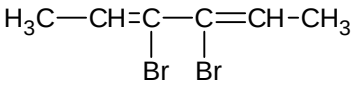
32. One among the following compounds will not give effervescence with $NaHCO_3$:

(A) $C_6H_5CO_2H$

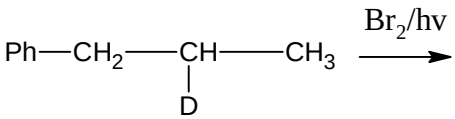
(B) 

(C) C_6H_5OH

(D) 

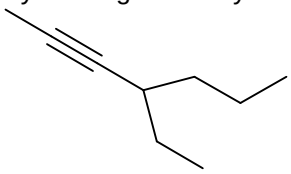
33. 

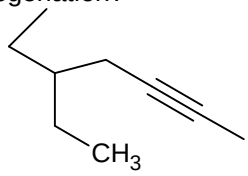
How many geometrical isomers are possible for this compound?
(A) 2
(B) 3
(C) 4
(D) 6

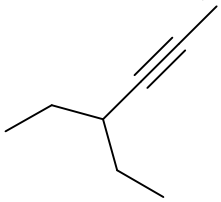
34. 

Product of the above reaction will be:
(A) Diastereomers
(B) Racemic mixture
(C) Meso
(D) Constitutional isomers

35. Which alkyne will give 3-ethyl hexane on catalytic hydrogenation?

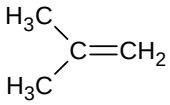
(A) 

(B) 

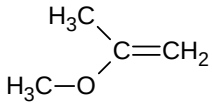
(C) 

(D) All of these

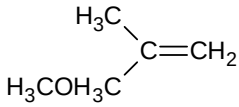
36. Arrange the above in the decreasing order of reactivity towards HBr:



(a)

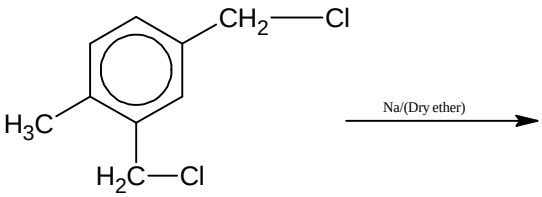


(b)

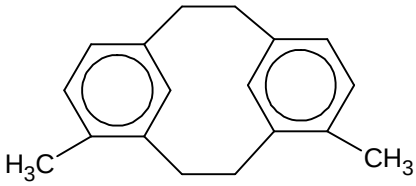


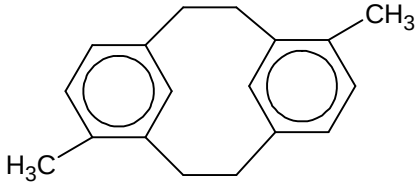
(c)

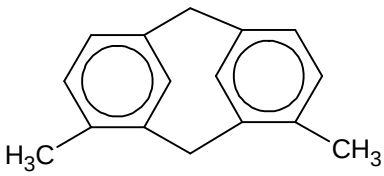
(A) a > b > c
(B) b > a > c
(C) b > c > a
(D) a > c > b

37. 

Products obtained in above Wurtz reaction is:

(A) 

(B) 

(C) 

(D) Both (A) and (B)

38. Number of waves made by a Bohr electron in one complete revolution in 3rd orbit is
(A) 2
(B) 3
(C) 4
(D) 1

39. In atom two electrons move around the nucleus in circular orbits of radii R and 4R. The ratio of the time taken by them to complete one revolution is:
(A) 1 : 4

(B) 4 : 1
(C) 1 : 8
(D) 8 : 7

40. Two closed vessel A and B of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow open tube. If the temperature of one is now maintained at T_1 and other at T_2 (where $T_1 > T_2$) then what will be the final pressure?

(A) $\frac{T_1}{2P_1T_2}$

(B) $\frac{2P_1T_2}{T_1+T_2}$

(C) $\frac{2P_1T_1}{T_1-T_2}$

(D) $\frac{2P_1}{T_1+T_2}$

41. A sample of H_2SO_4 ($density\ 1.787\ g\ mL^{-1}$) is labelled as 86% by weight. What volume of acid has to be used to make 1 litre of 0.2 M H_2SO_4?

(A) 12.75 mL
(B) 10.5 mL
(C) 21.25 mL
(D) 18 mL

42. 25 mL of H_2O_2 solution were added to excess of acidified solution of KI. The iodine so liberated required 20 mL of 0.1 N $Na_2S_2O_3$ for titration. Calculate the strength of H_2O_2 in terms of normality and volume strength.

(A) $\frac{2}{25}$, 0.448

(B) $\frac{3}{25}$, 0.224

(C) 35, 22.4
(D) 25, 0.224

43. One mole of helium at 27^oC and 1 atm pressure undergoes a reversible adiabatic expansion until the volume increases 100 times. Calculate the final pressure and temperature.

(A) 4.57×10^{-4} atm, 300^oC
(B) 4.57×10^{-4} atm, -259.3^oC
(C) 3.27×10^{-2} atm, -250^oC
(D) 4.57×10^{-8} atm, -400.79^oC

44. An athlete is given 100 g of glucose of energy equivalent to 1560 kJ. He utilizes 50% of this gained energy in the event. In order to avoid storage of energy in the body, calculate the mass of water he would need to perspire. Enthalpy of H_2O for evaporation is $44\ kJ\ mol^{-1}$.

(A) 346 g
(B) 316 g
(C) 323 g
(D) 319 g

45. One mole of $N_2O_4(g)$ *at* $300\ K$ is kept in a closed container under one atmosphere. It is heated to 600 K when $N_2O_4(g)$ decomposes to $NO_2(g)$. If the resultant pressure is 2.4 atm, the percentage dissociation by mass of $N_2O_4(g)$ is

(A) 10%
(B) 20%
(C) 30%
(D) 40%

46. pH of a mixture of 1M benzoic acid (pKa = 4.20) and 1M C_6H_5COONa is 4.5. In 300 ml buffer, benzoic acid is $[\log 2 = 0.3]$

(A) 200 ml
(B) 150 ml
(C) 100 ml
(D) 50 ml

47. Select the **correct** statement regarding Slater rules.

(A) Z_{eff} *on* $4s$ electron is more than $3d$ electron because it is filled completely before $3d$
(B) In P atom, $1s$ electrons are more shielded than $2p$ electrons
(C) In Zn atom, $3d$ electrons provide effective shielding to $3s$ electrons
(D) In Zn, Z_{eff} *on* $3s$ and $3p$ electrons is equal

48. A_0 / 2 atoms of $X(g)$ are converted into $X^+(g)$ by energy E_1. A_0 / 2 atoms of $X(g)$ are converted into $X^-(g)$ of energy E_2. Hence, ionisation energy and electron affinity of $X(g)$ are :

(A) $\frac{2E_1}{A_0}, \frac{2(E_1 - E_2)}{A_0}$
(B) $\frac{2E_1}{A_0}, \frac{2E_2}{A_0}$
(C) $\frac{(E_1 - E_2)}{A_0}, \frac{2E_2}{A_0}$
(D) none of these

49. The correct order of increasing $s-$character (in percentage) in the hybrid orbitals in below molecules /ions is (assume all hybrid orbitals are exactly equivalent) :

CO_3^{2-}	XeF_4	I_3^-	NCl_3	$BeCl_2$
I	*II*	*III*	*IV*	*V*

(A) $II < III < IV < I < V$
(B) $II < IV < III < V < I$
(C) $III < II < I < V < IV$
(D) $II < IV < III < I < V$

50. As the tendency to form $p\pi - d\pi$ bond decreases, the tendency for the polymerisation increases. So the **correct** order of tendency of polymerisation is :

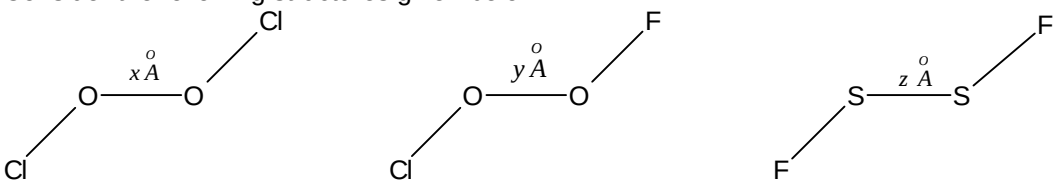
(A) $SiO_4^{4-} < PO_4^{3-} < SO_4^{2-} < ClO_4^-$

(B) $PO_4^{3-} < SiO_4^{4-} < SO_4^{2-} < ClO_4^-$

(C) $ClO_4^- < SO_4^{2-} < SiO_4^{4-} < PO_4^{3-}$

(D) $SiO_4^{4-} > PO_4^{3-} > SO_4^{2-} > ClO_4^-$

51. Consider the following structures given below:



The **correct** order of d_{O-O} and d_{S-S} is :

(A) $x > y > z$

(B) $z > x > y$

(C) $y > x > z$

(D) $z > y > x$

52. Given:

$E^o_{Cl_2|Cl^-} = +1.36\,V$ $\quad$ $E^o_{I_2|I^-} = +0.53\,V$

$E^o_{Ag^+|Ag} = +0.70V$ $\quad$ $E^o_{Na^+|Na} = -2.71\,V$

$E^o_{Li^+|Li} = -3.04\,V$

For the species : $I^-, Ag, Cl^-, Li, Na;$ choose the **correct** order of reducing strength :

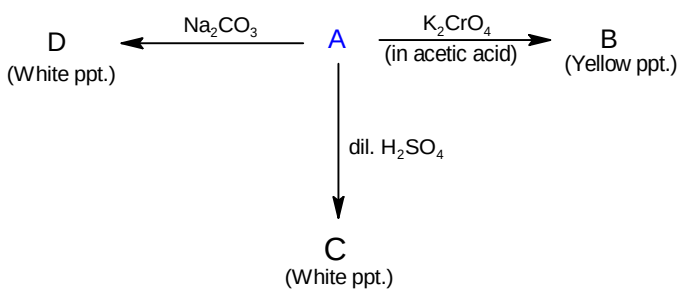
(A) $Li < Na < I^- < Ag < Cl^-$

(B) $Li < Na < Ag < Cl^- < I^-$

(C) $Li > Na > I^- > Ag > Cl^-$

(D) $Li > Na > Ag > Cl^- > I^-$

53.



If A is the metallic salt, then the white ppt. of D must be of:

(A) strontium carbonate

(B) red lead

(C) barium carbonate

(D) calcium carbonate

54. $H_3PO_2 \xrightarrow{140^oC} A \xrightarrow{220^oC} B \xrightarrow{320^oC} C.$ Compound (C) is:

(A) H_2PO_3

(B) H_3PO_3

(C) $(HPO_3)_n$

(D) $H_4P_2O_7$

55. $RCl \xrightarrow[Si]{Cu\text{ - powder}} R_2SiCl_2 \xrightarrow{H_2O} R_2Si(OH)_2 \xrightarrow{condensation} A$

Compound (A) is :

(A) a linear silicone

(B) a chlorosilane

(C) a linear silane

(D) a network silane

56. Which of the following oxide(s) gives brown ppt. on reaction with conc. HNO_3?

(A) PbO

(B) SnO

(C) NO_2

(D) Pb_3O_4

57. Identify the reaction(s) in which the stereochemistry of underlined species has not changed.

(A) $\underline{XeF_2} + PF_5 \rightarrow [XeF]^+[PF_6]^-$

(B) $\underline{XeF_4} + SbF_5 \rightarrow [XeF_3]^+[SbF_6]^-$

(C) $\underline{XeF_4} + SbF_3 \rightarrow [XeF_3]^+[SbF_4]^-$

(D) $CH_3 - CH_2 - \overset{+}{\underline{N}} \equiv C \longrightarrow CH_3 - CH_2 - C \equiv N$

58. Select the **incorrect** order for given properties:

(A) Thermal stability : $BaSO_4 > SrSO_4 > CaSO_4$

(B) Solubility : $BaSO_4 > SrSO_4 > CaSO_4$

(C) Thermal stability : $Li_2CO_3 < Na_2CO_3 < K_2CO_3$

(D) Solubility : $Li_2CO_3 < Na_2CO_3 < K_2CO_3$

59. Choose the **correct** statement from the following.

(A) HOMO for N_2 molecule is $\pi_b M.O.$

(B) LUMO for N_2 ion is $\pi^* M.O.$

(C) HOMO for CO molecule is B.M.O. from C-atom

(D) Among halogen pale yellow colour of F_2 only is not due to HOMO – LUMO transition.

60. Which of the following order is **correct**?

(A) $C_2H_5OH < CH_3OCH_3$ (boiling point)

(B) $NH_3 < PH_3$ (boiling point)

(C) $BeC_2O_4 > BaC_2O_4$ (solubility in water)

(D) $BaCrO_4 > BeCrO_4$ (solubility in water)

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

61. The equation of the curve, which is the reflection (image) of the curve $xy = c^2$, where c is constant with respect to the line $x + y = 4$, is
(A) $xy = c^2$
(B) $(x+4)(y+4) = c^2$
(C) $(x-4)(y-4) = c^2$
(D) None

62. If non-zero numbers a, b & c are in H.P. then the straight line $\frac{x}{a}+\frac{y}{b}+\frac{1}{c}=0$ always passes through a fixed point, which also lies on:
(A) $2x + y = 0$
(B) $x^2 + y^2 = 15$
(C) $y^2 = 8x$
(D) $x^2 + 9y = 0$

63. The equation of the circumcircle of an equilateral triangle is $x^2 + y^2 + 2gx + 2fy + c = 0$ and one vertex of the triangle is (1,1). The equation of incircle of the triangle is
(A) $4\left(x^2+y^2\right) = g^2 + f^2$
(B) $4\left(x^2+y^2\right) + 8gx + 8fy = (1-g)(1+3g) + (1-f)(1+3f)$
(C) $4\left(x^2+y^2\right) + 8gx + 8fy = g^2 + f^2$
(D) None of these

64. Let f(x, y) = 0 be the equation of a circle. If $f(0, \lambda) = 0$ has equal roots $\lambda = 2, 2$ and $f(\lambda, 0) = 0$ has roots $\lambda = \frac{4}{5}, 5$ then the centre of the circle is
(A) (2, 29/10)
(B) (29/10, 2)
(C) (–2, 29/10)
(D) None of these

65. Two distinct chords drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$, where $pq \neq 0$, are bisected by the x-axis. Then
(A) $|p| = |q|$
(B) $p^2 = 8q^2$
(C) $p^2 < 8q^2$
(D) $p^2 > 8q^2$

66. The point (a, 2a) is an interior point of the region bounded by the parabola $y^2 = 16x$ and the double ordinate through the focus. Then a belongs to the open interval
(A) $a < 4$
(B) $0 < a < 4$
(C) $0 < a < 2$
(D) $a > 4$

67. The ends of a line segment are P(1, 3) and Q(1, 1). R is a point on the line segment PQ such that PR : QR = 1 : λ. If R is an interior point of the parabola $y^2 = 4x$ then
(A) $\lambda \in (0,1)$
(B) $\lambda \in \left(-\frac{3}{5},1\right)$
(C) $\lambda \in \left(\frac{1}{2},\frac{3}{5}\right)$
(D) None of these

68. The set of values of $\lambda \in R$ such that $\tan^2\theta + \sec\theta = \lambda$ holds for some θ is
(A) $(-\infty,1]$
(B) $(-\infty,-1]$
(C) ϕ
(D) $[-1,+\infty)$

69. P is a variable point on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=2$ whose foci and F_1 and F_2. The maximum area (in unit^2) of the ΔPFF' is
(A) $2b\sqrt{a^2-b^2}$
(B) $\sqrt{2b\sqrt{a^2-b^2}}$
(C) $b\sqrt{a^2-b^2}$
(D) $2a\sqrt{a^2-b^2}$

70. Which of the following points is an exterior point of the ellipse $16x^2+9y^2-16x-32=0$?
(A) $\left(\frac{1}{2},2\right)$
(B) $\left(\frac{1}{4},1\right)$
(C) $(3,-2)$
(D) None of these

71. For the hyperbola $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{\sin^2\alpha}=1$, which of the following remains constant when α varies?
(A) abscissae of vertices
(B) abscissae of foci
(C) eccentricity
(D) directrix

72. The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. Then the value of b^2 is
(A) 5
(B) 7
(C) 9
(D) 1

73. The line px + qy = r touches the hyperbola $b^2x^2-a^2y^2=a^2b^2$ if
(A) $a^2p^2+b^2q^2=r^2$
(B) $a^2p^2-b^2q^2=r^2$
(C) $a^2q^2+b^2p^2=r^2$
(D) $a^2q^2-b^2p^2=r^2$

74. Any ordinate on P of the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$ meets the auxiliary circle at Q. Then locus of points of intersection of normals at P and Q respective curve is
(A) $x^2+y^2=8$
(B) $x^2+y^2=34$
(C) $x^2+y^2=64$
(D) $x^2+y^2=15$

75. The locus of a point $P(\alpha,\beta)$ moving under the condition that the line $y=\alpha x+\beta$ is a tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$is
(A) a circle
(B) an ellipse
(C) a hyperbola
(D) a parabola

76. The number of distinct normal lines from the exterior point (0, c), c > b, to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is
(A) 3
(B) 4
(C) 2
(D) 1

77. The normal to the rectangular hyperbola $xy=c^2$ at the point 't_1' meets the curve again at the point 't_2'. The value of $t_1^3.t_2$ is
(A) 1
(B) c
(C) –c
(D) –1

78. If α,β are roots of $x^2+px+q=0$ and γ,δ are the roots of $x^2+px-r=0$ then $(\alpha-\gamma)(\alpha-\delta)$ is equal to
(A) q + r
(B) q – r
(C) $-(q+r)$
(D) $-(p+q+r)$

79. Let $\alpha\neq\beta$ and $\alpha^2+3=5\alpha$ while $\beta^2=5\beta-3$. The quadratic equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ is
(A) $3x^2-31x+3=0$
(B) $3x^2-19x+3=0$
(C) $3x^2+19x+3=0$
(D) None of these

80. Let $z=1-t+i\sqrt{t^2+t+2}$, where t is a real parameter. The locus of z in the Arg and plane is
(A) a hyperbola
(B) an ellipse
(C) a straight line
(D) none of these

81. The area of the triangle whose vertices are i,α,β, where $i=\sqrt{-1}$ and α,β are the non-real cube roots of unity, is
(A) $\frac{3\sqrt{3}}{2}$
(B) $\frac{3\sqrt{3}}{4}$
(C) 0
(D) $\frac{\sqrt{3}}{4}$

82. Number of all possible outcomes by throwing 3 identical dice are
(A) 6^3
(B) 6^3-6^2+1
(C) 42
(D) 56

83. In a room there are 12 bulbs of the same wattage, each having a separate switch. The number of ways to light the room with different amounts of illumination is
(A) 12^2-1
(B) 2^{12}
(C) $2^{12}-1$
(D) None of these

84. The number of 5-digit numbers that can be made using the digits 1 and 2 and in which at least one digit is different, is
(A) 30
(B) 31
(C) 32
(D) None of these

85. The set of values of $k \in R$ such that the equation $\cos 2\theta + \cos\theta + k = 0$ admits of a solution for θ is

(A) $\left[0, \frac{9}{8}\right]$

(B) $[0, +\infty)$

(C) $[-2, 0]$

(D) None of these

86. The range of values of λ for which the point $(\lambda, -1)$ is exterior to both the parabolas $y^2 = |x|$ is

(A) $(0,1)$

(B) $(-1,1)$

(C) $(-1,0)$

(D) None of these

87. A vertical pole PO is standing at the centre O of a square ABCD. If AC subtends an angle 90^0 at the top, P, of the pole then the angle subtended by a side of the square at P is

(A) 45^0

(B) 30^0

(C) 60^0

(D) None of these

88. The sum of infinite terms of a decreasing GP is equal to the greatest value of the function $f(x) = x^3 + 3x - 9$ in the interval $[-2,3]$ and the difference between the first two terms is f' (0). Then the common ratio of the GP is

(A) $-\frac{2}{3}$

(B) $\frac{4}{3}$

(C) $\frac{2}{3}$

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

89. The sum of $\frac{3}{1.2}.\frac{1}{2} + \frac{4}{2.3}.\left(\frac{1}{2}\right)^2 + \frac{5}{3.4}.\left(\frac{1}{3}\right)^3 + ...$ to n terms is equal to

(A) $1 - \frac{1}{(n+1)2^n}$

(B) $1 - \frac{1}{n.2^{n-1}}$

(C) $1 + \frac{1}{(n+1)2^n}$

(D) None of these

90. If $\cos^{-1}\lambda + \cos^{-1}\mu + \cos^{-1}\nu = 3\pi$ then $\lambda\mu + \mu\nu + \nu\lambda$ is equal to

(A) –3

(B) 0

(C) 3

(D) –1