

GENERAL INSTRUCTIONS

- This question paper contains total 125 questions divided into four parts:

Part I: Physics Q. No - 1 to 40

Part II: Chemistry Q. No - 41 to 80

Part III: Mathematics Q. No - 81 to 120

Part IV: English Q. No - 121 to 125

- All questions are multiple choice questions with four options, only one of them is correct.
- For each correct response, the candidate will get 1 mark.
- There is no negative marking for the wrong answer.
- The test is of 21/2 hours duration

PART-I PHYSICS

1. The electric resistance of a certain wire of iron is R . If its length and radius are both doubled, then

- (a) the resistance and the specific resistance, will both remain unchanged
- (b) the resistance will be doubled and the specific resistance will be halved
- (c) the resistance will be halved and the specific resistance will remain unchanged
- (d) the resistance will be halved and the specific resistance will be doubled

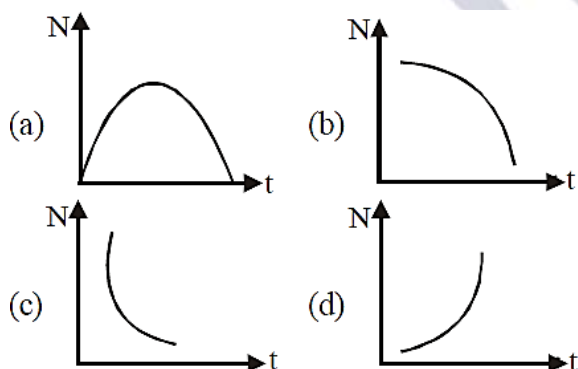
2. Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, then the power of the other lens will be

- (a) 1.66D
- (b) 4.00D
- (c) -100D
- (d) -3.75D

3. If the kinetic energy of a free electron doubles, it's de-Broglie wavelength changes by the factor

- (a) 2
- (b) $\frac{1}{2}$
- (c) $\sqrt{2}$
- (d) $\frac{1}{\sqrt{2}}$

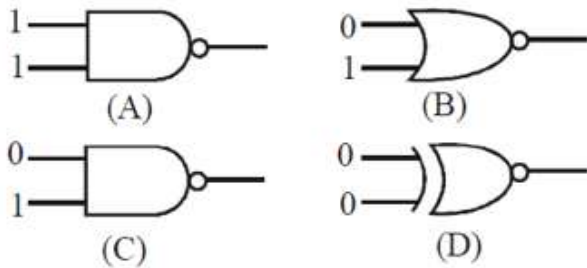
4. Radioactive element decays to form a stable nuclide, then the rate of decay of reactant is shown by



5. The ratio of the energies of the hydrogen atom in its first to second excited states is

- (a) $\frac{1}{4}$
- (b) $\frac{4}{9}$
- (c) $\frac{9}{4}$
- (d) 4

6. Which of the following gates will have an output of 1?

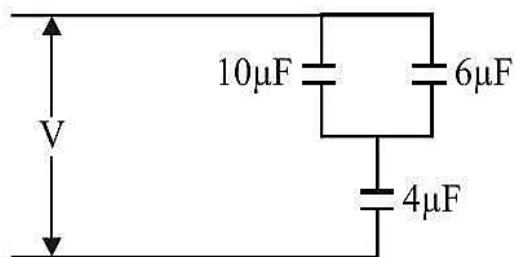


- (a) D (b) A
(c) B (d) C

7. A point charge q is rotated along a circle in the electric field generated by another point charge Q . The work done by the electric field on the rotating charge in one complete revolution is

- (a) zero
(b) positive
(c) negative
(d) zero if the charge Q is at the centre and nonzero otherwise.

8. The equivalent capacitance of the combination of the capacitors is



- (a) $3.20 \mu\text{F}$ (b) $7.80 \mu\text{F}$
(c) $3.90 \mu\text{F}$ (d) $2.16 \mu\text{F}$

9. The half-life period and the mean life period of a radioactive element are denoted respectively by T_h and T_m . Then

- (a) $T_h = T_m$ (b) $T_h > T_m$
(c) $T_h < T_m$ (d) $T_h \geq T_m$

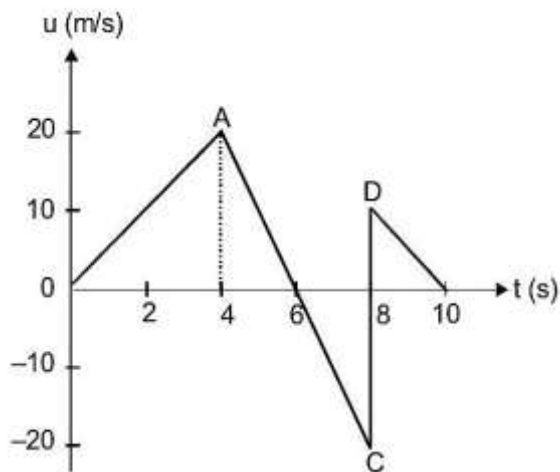
10. In a common base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA . The value of the base current amplification factor (β) will be

- (a) 49 (b) 50
(c) 51 (d) 48

11. The magnetic field at a distance r from a long wire carrying current i is 0.4 tesla . The magnetic field at a distance $2r$ is

- (a) 0.2 tesla (b) 0.8 tesla
(c) 0.1 tesla (d) 1.6 tesla

12. The velocity-time graph of a body moving in a straight line is shown in fig. Find the displacement and distance travelled by the body in 10 seconds.



- (a) 50 m, 90 m (b) 5 m, 9 m
(c) 9 m, 5 m (d) 90 m, 50 m

13. An electric dipole is kept in a uniform electric field. It experiences

- (a) a force and a torque
(b) a force, but no torque
(c) a torque but no net force
(d) neither a force nor a torque

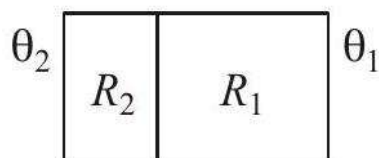
14. A person swims in a river aiming to reach exactly on the opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water is

- (a) 1.0 m/s (b) 0.5 m/s
(c) 0.25 m/s (d) 0.43 m/s

15. A rain drop of radius 0.3 mm has a terminal velocity in air is 1 m/s. The viscosity of air is 8×10^{-5} poise. The viscous force on it is

- (a) 45.2×10^{-4} dyne
(b) 101.73×10^{-5} dyne
(c) 16.95×10^{-4} dyne
(d) 16.95×10^{-5} dyne

16. Consider a pair of insulating blocks with thermal resistances R_1 and R_2 as shown in the figure. The temperature θ at the boundary between the two blocks is



- (a) $(\theta_1 \theta_2 \sqrt{R_1 R_2}) / (\theta_1 + \theta_2) (R_1 + R_2)$
(b) $(\theta_1 R_1 + \theta_2 R_2) / (R_1 + R_2)$
(c) $[(\theta_1 + \theta_2) R_1 R_2] / (R_1^2 + R_2^2)$
(d) $(\theta_1 R_2 + \theta_2 R_1) / (R_1 + R_2)$

17. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant $k = 50$ N/m. The maximum compression of the spring would be



- (a) 0.5 m (b) 0.15 m
(c) 0.12 m (d) 1.5 m

18. A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one of the following will not be affected?

- (a) Angular velocity (b) Angular momentum
(c) Moment of inertia (d) Rotational kinetic energy

19. The Young's modulus of a perfectly rigid body is

- (a) unity
(b) zero
(c) infinity
(d) some finite non-zero constant

20. The figure below shows currents in a part of electric circuit. The current i is

- (a) 1.7amp (b) 3.7amp
(c) 1.3amp (d) 1amp

21. In an electromagnetic wave

- (a) power is transmitted along the magnetic field
(b) power is transmitted along the electric field
(c) power is equally transferred along the electric and magnetic fields
(d) power is transmitted in a direction perpendicular to both the fields

22. A particle covers half of the circle of radius r . Then the displacement and distance of the particle are respectively

- (a) $2\pi r, 0$ (b) $2r, \pi r$
(c) $\frac{\pi r}{2}, 2r$ (d) $\pi r, r$

23. A metal ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet

- (a) is equal to g
(b) is less than g
(c) is more than g
(d) depends on the diameter of ring and length of magnet

24. A particle having a mass 0.5 kg is projected under gravity with a speed of 98 m/sec at an angle of 60° . The magnitude of the change in momentum (in N-sec) of the particle after 10 seconds is [$g = 9.8 \text{ m/sec}^2$]

- (a) 0.5 (b) 49
(c) 98 (d) 490

25. For a series RLC circuit $R = X_L = 2X_C$. The impedance of the circuit and phase difference between V and I respectively will be

(a) $\frac{\sqrt{5}R}{2}, \tan^{-1}(2)$ (b) $\frac{\sqrt{5}R}{2}, \tan^{-1}(1/2)$

(c) $\sqrt{5}X_C, \tan^{-1}(2)$ (d) $\sqrt{5}R, \tan^{-1}(1/2)$

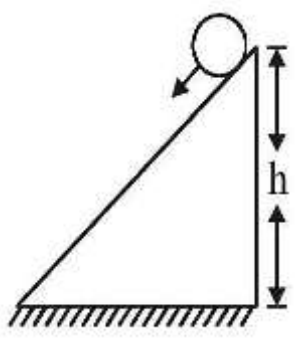
26. A man holding a rifle (mass of person and rifle together is 100 kg) stands on a smooth surface and fires 10 shots horizontally in 5 sec. Each bullet has a mass 10 g with a muzzle velocity of 800 ms^{-1} . The velocity which the rifle man attains after firing 10 shots will be

(a) 8 ms^{-1} (b) 0.8 ms^{-1}
(c) 0.08 ms^{-1} (d) -0.8 ms^{-1}

27. Escape velocity when a body of mass m is thrown vertically from the surface of the earth is v , what will be the escape velocity of another body of mass $4m$ is thrown vertically

(a) v (b) $2v$
(c) $4v$ (d) None of these

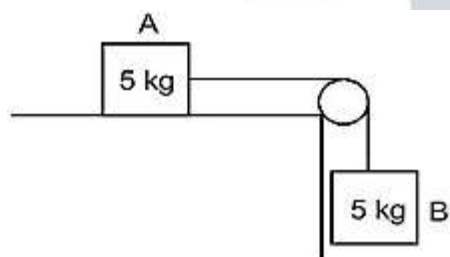
28. A solid cylinder of mass m and radius R rolls down inclined plane without slipping. The speed of its C.M. when it reaches the bottom is



(a) $\sqrt{2gh}$ (b) $\sqrt{4gh/3}$

(c) $\sqrt{3/4gh}$ (d) $\sqrt{4gh}$

29. A block of mass 5 kg resting on a horizontal surface is connected by a cord, passing over a light frictionless pulley to a hanging block of mass 5 kg. The coefficient of kinetic friction between the block and the surface is 0.5. Tension in the cord is : ($g = 9.8 \text{ m/sec}^2$)



(a) 49 N (b) Zero
(c) 36.75 N (d) 2.45 N

30. A and B are two wires. The radius of A is twice that of B. They are stretched by the same load. Then the stress on B is

(a) equal to that on A (b) four times that on A
(c) two times that on A (d) half that on A

31. A liquid is allowed to flow into a tube of truncated cone shape. Identify the correct statement from the following.

(a) The speed is high at the wider end and low at the narrow end.

- (b) The speed is low at the wider end and high at the narrow end.
- (c) The speed is same at both ends in a stream line flow.
- (d) The liquid flows with uniform velocity in the tube.

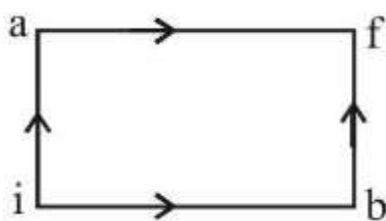
32. A planet revolves in an elliptical orbit around the sun. The semi-major and semi-minor axes are a and b . Then the square of time period, T is directly proportional to

- (a) a^3 (b) b^3
 (c) $\left(\frac{a+b}{2}\right)^3$ (d) $\left(\frac{a-b}{2}\right)^3$

33. The surface of a metal is illuminated with the light of 400 nm. The kinetic energy of the ejected photoelectrons was found to be 1.68 eV. The work function of the metal is ($hc = 1240 \text{ eV} \cdot \text{nm}$)

- (a) 3.09 eV (b) 1.42 eV
 (c) 1.51 eV (d) 1.68 eV

34. When a system is taken from state i to state f along the path iaf , it is found that $Q = 50 \text{ cal}$ and $W = 20 \text{ cal}$. Along the path ibf $Q = 36 \text{ cal}$. W along the path ibf is



- (a) 14 cal (b) 6 cal
 (c) 16 cal (d) 66 cal

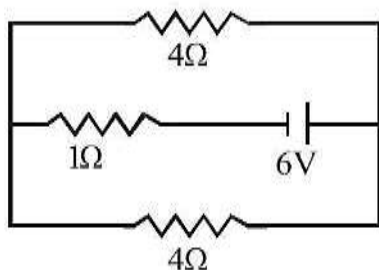
35. If the differential equation for a simple harmonic motion is $\frac{d^2y}{dt^2} + 2y = 0$, the time-period of the motion is

- (a) $\pi\sqrt{2} \text{ sec}$ (b) $\frac{\sqrt{2}}{\pi} \text{ sec}$
 (c) $\frac{\pi}{\sqrt{2}} \text{ sec}$ (d) $2\pi \text{ sec}$

36. Tube A has both ends open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is

- (a) 1:2 (b) 1:4
 (c) 2:1 (d) 4:1

37. The current in the 1Ω resistor shown in the circuit is



- (a) $\frac{2}{3} \text{ A}$ (b) 3 A
 (c) 6 A (d) 2 A

38. The work done by an uniform magnetic field, on a moving charge is

- (a) zero because $\vec{F}$ acts parallel to $\vec{v}$

(b) positive because $\vec{F}$ acts perpendicular to $\vec{v}$

(c) zero because $\vec{F}$ acts perpendicular to $\vec{v}$

(d) negative because $\vec{F}$ acts parallel to $\vec{v}$

39. In Young's double slit experimental setup, if the wavelength alone is doubled, the bandwidth β becomes

(a) $\frac{\beta}{2}$ (b) 2β

(c) 3β (d) β

40. In Young's double slit experiment, the central point on the screen is

(a) bright

(b) dark

(c) first bright and then dark

(d) first dark and then bright

PART-II CHEMISTRY

41. The work done in ergs for the reversible expansion of one mole of an ideal gas from a volume of 10 litres to 20 litres at 25°C is

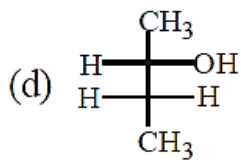
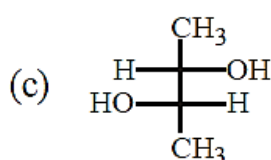
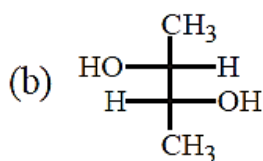
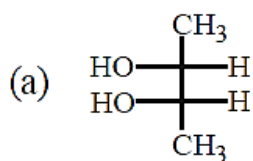
(a) $2.303 \times 298 \times 0.082 \log 2$

(b) $298 \times 10^7 \times 8.31 \times 2.303 \log 2$

(c) $2.303 \times 298 \times 0.082 \log 0.5$

(d) $8.31 \times 10^7 \times 298 - 2.303 \log 0.5$

42. A Fischer projection of (2R, 3S)-2,3-butanediol is :



43. Arrange the following particles in increasing order of values of e/m ratio : electron (e), proton (p), neutron (n) and α -particle (α) -

(a) n, p, e, α (b) n, α , p, e

(c) n, p, α , e (d) e, p, n, α

44. Acidified potassium dichromate is treated with hydrogen sulphide. In the reaction, the oxidation number of chromium

(a) Increases from +3 to +6 (b) Decreases from +6 to +3

(c) Remains unchanged (d) Decreases from +6 to +2

45. For the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ if $\frac{\Delta[\text{NH}_3]}{\Delta t} = 2 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$, then value of $\frac{-\Delta[\text{H}_2]}{\Delta t}$ would be

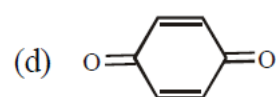
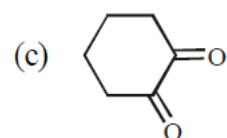
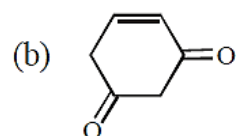
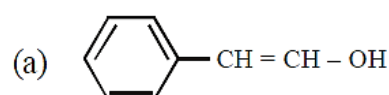
- (a) $1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ (b) $3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
(c) $4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ (d) $6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

46. The value of K_c for the reaction:

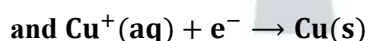
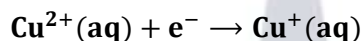
$\text{A} + 3\text{B} \rightleftharpoons 2\text{C}$ at 400°C is 0.5. Calculate the value of K_p

- (a) 1.64×10^{-4} (b) 1.64×10^{-6}
(c) 1.64×10^{-5} (d) 1.64×10^{-3}

47. Tautomerism is not exhibited by –



48. The electrode potentials for



are +0.15 V and +0.50 V, respectively. The value of $E^\circ_{\text{Cu}^{2+}/\text{Cu}}$ will be:

- (a) 0.500 V (b) 0.325 V
(c) 0.650 V (d) 0.150 V

49. Deep sea divers used to respire a mixture of

- (a) Oxygen and argon (b) Oxygen and helium
(c) Oxygen and nitrogen (d) Oxygen and hydrogen

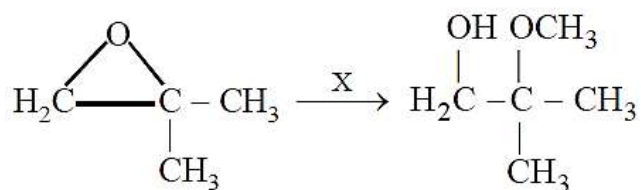
50. The wavelengths of two photons are $2000\text{\AA}$ and $4000\text{\AA}$ respectively. What is the ratio of their energies?

- (a) $\frac{1}{4}$ (b) 4
(c) $\frac{1}{2}$ (d) 2

51. Ethylene glycol, on oxidation with per-iodic acid, gives

- (a) Oxalic acid (b) Glycol
(c) Formaldehyde (d) Glycolic acid

52. What is X in the following change?



- (a) $\text{CH}_3\text{OH}, \text{H}_2\text{SO}_4$
 (b) $\text{CH}_3\text{OH}, \text{CH}_3\text{O}^-\text{Na}^+$
 (c) $\text{H}_2\text{O} / \text{H}_2\text{SO}_4$ followed by CH_3OH
 (d) $\text{CH}_3\text{MgBr} / \text{H}_3\text{O}^+$

53. In a closed insulated container, a liquid is stirred with a paddle to increase its temperature. In this process, which of the following is true?

- (a) $\Delta E = W = Q = 0$ (b) $\Delta E \neq 0, Q = W = 0$
 (c) $\Delta E = W \neq 0, Q = 0$ (d) $\Delta E = Q \neq 0, W = 0$

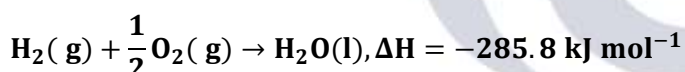
54. At low pressure, the van der Waal's equation is reduced to

- (a) $Z = \frac{PV_m}{RT} = 1 - \frac{a}{VRT}$ (b) $Z = \frac{PV_m}{RT} = 1 + \frac{b}{RT} P$
 (c) $PV_m = RT$ (d) $Z = \frac{PV}{RT} = 1 - \frac{a}{RT}$

55. Copper sulphate solution reacts with KCN to give

- (a) $\text{Cu}(\text{CN})_2$ (b) CuCN
 (c) $\text{K}_2[\text{Cu}(\text{CN})_4]$ (d) $\text{K}_3[\text{Cu}(\text{CN})_4]$

56. For the reaction

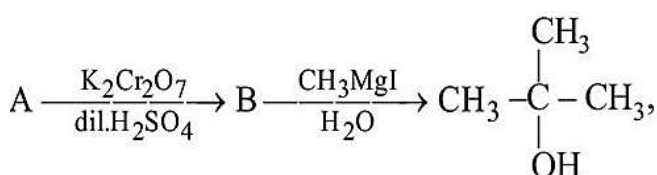


$$\Delta S = -0.163 \text{ kJ mol}^{-1} \text{ K}^{-1}.$$

What is the value of free energy change at 27°C for the reaction?

- (a) $-236.9 \text{ kJ mol}^{-1}$ (b) $-281.4 \text{ kJ mol}^{-1}$
 (c) $-334.7 \text{ kJ mol}^{-1}$ (d) $+334.7 \text{ kJ mol}^{-1}$

57.



the reactant A is

- (a) $\text{CH}_3\text{CHOHCH}_3$ (b) CH_3COCH_3
 (c) $\text{C}_2\text{H}_5\text{OH}$ (d) CH_3COOH

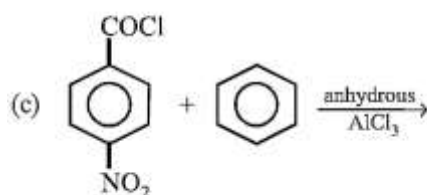
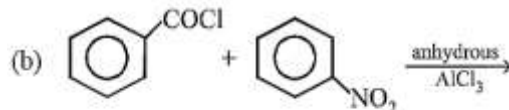
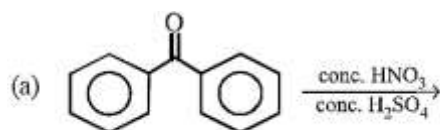
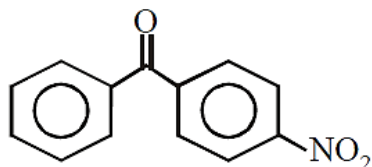
58. Bragg's law is given by the which of the following equation?

- (a) $n\lambda = 2\theta \sin \theta$ (b) $n\lambda = 2 d \sin \theta$
(c) $2n\lambda = d \sin \theta$ (d) $n \frac{\theta}{2} = \frac{d}{2} \sin \theta$

59. The reaction $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$ is of first order. If volume of reaction vessel is reduced to $1/3$, the rate of reaction would be

- (a) $1/3$ times (b) $2/3$ times
(c) 3 times (d) 6 times

60. Which are the starting materials for the preparation of?



(d) Any of the three

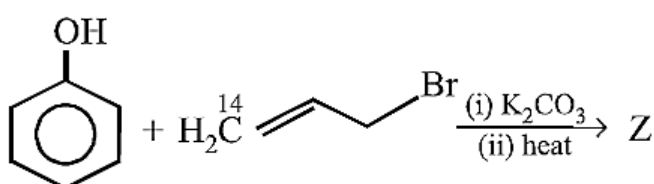
61. Which element gives maximum number of oxides?

- (a) V (b) Cr
(c) Mn (d) Fe

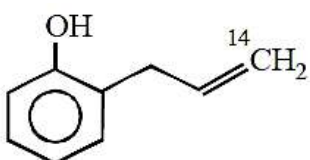
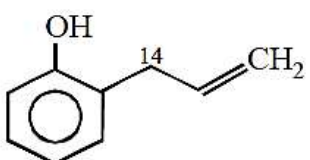
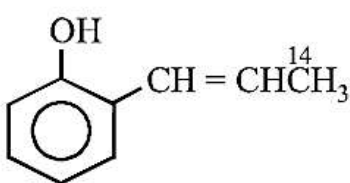
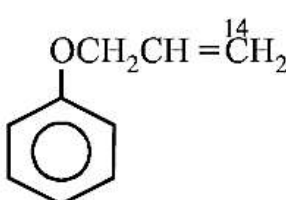
62. An organic compound 'A' has the molecular formula $\text{C}_3\text{H}_6\text{O}$, it undergoes iodoform test. When saturated with dil. HCl it gives 'B' of molecular formula $\text{C}_9\text{H}_{14}\text{O}$. A and B respectively are

- (a) Propanal and mesitylene
(b) Propanone and mesityl oxide
(c) Propanone and 2,6-dimethyl-2, 5-heptadien-4-one
(d) Propanone and mesitylene oxide

63.



Here Z is

- (a) 
- (b) 
- (c) 
- (d) 

64. Calculate the entropy change in melting 1 mole of ice at 273 K, $\Delta H_f^0 = 6.025 \text{ kJ/mole}$ -

- (a) $11.2 \text{ JK}^{-1} \text{ mol}^{-1}$ (b) $22.1 \text{ JK}^{-1} \text{ mol}^{-1}$
(c) $15.1 \text{ JK}^{-1} \text{ mol}^{-1}$ (d) $5.1 \text{ JK}^{-1} \text{ mol}^{-1}$

65. The rate constant is doubled when temperature increases from 27°C to 37°C . Activation energy in kJ is

- (a) 34 (b) 54
(c) 100 (d) 50

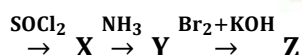
66. In the reaction, $\text{C}_6\text{H}_5\text{OH} \xrightarrow{\text{NaOH}} (\text{A})$

$\xrightarrow[140^\circ\text{C}, (4-7)\text{atm}]{\text{CO}_2}$ (B) $\xrightarrow{\text{HCl}}$ (C), the compound (C) is

- (a) Benzoic acid (b) Salicylaldehyde
(c) Chlorobenzene (d) Salicylic acid

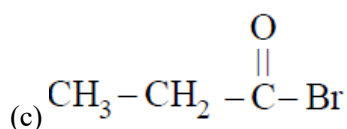
67. Starting from propanoic acid, the following reactions were carried out

Propanoic acid



What is the compound Z ?

- (a) $\text{CH}_3 - \text{CH}_2 - \text{Br}$
(b) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$



- (d) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NH}_2$

68. Calculate the energy needed to convert three moles of sodium atoms in the gaseous state to sodium ions.

The ionization energy of sodium is 495 kJ mol^{-1}

- (a) 1485 kJ (b) 495 kJ
(c) 148.5 kJ (d) None

69. The uncertainty in position and velocity of a particle are 10^{-10} m and $5.27 \times 10^{-24} \text{ ms}^{-1}$ respectively.

Calculate the mass of the particle is ($h = 6.625 \times 10^{-34} \text{ Js}$) –

- (a) 0.099 kg (b) 0.99 g
(c) 0.92 kg (d) None

70. Choose the complex which is paramagnetic

- (i) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (ii) $\text{K}_3[\text{Cr}(\text{CN})_6]$

- (iii) $\text{K}_3[\text{Fe}(\text{CN})_6]$ (iv) $\text{K}_2[\text{Ni}(\text{CN})_4]$

- (a) (i), (ii) and (iii) (b) (i), (iii) and (iv)
(c) (ii), (iii), and (iv) (d) (i), (ii) and (iv)

71. Phosphine is generally prepared in the laboratory:

- (a) By heating phosphorus in a current of hydrogen
(b) By heating white phosphorus with an aqueous solution of caustic potash
(c) By decomposition of P_2H_4 at 110°C
(d) By heating red phosphorus with an aqueous solution of caustic soda

72. In a hydrogen - oxygen fuel cell, combustion of hydrogen occurs to :

- (a) Produce high purity water
(b) Create potential difference between the two electrodes
(c) Generate heat
(d) Remove adsorbed oxygen from electrode surfaces

73. Among the following molecule

- (i) XeO_3 (ii) XeOF_4 (iii) XeF_6

Those having same number of lone pairs on Xe are

- (a) (i) and (ii) only (b) (i) and (iii) only
(c) (ii) and (iii) only (d) (i), (ii) and (iii)

74. An alkene of molecule formula C_9H_{18} on ozonolysis gives 2, 2-dimethylpropanal & 2-butanone, then the alkene is

- (a) 2,2,4-trimethyl-3-hexene (b) 2,2, 6-trimethyl-3-hexene
(c) 2,3,4-trimethyl-2-hexene (d) 2, 2-dimethyl -2-heptene

75. Glucose when heated with CH_3OH in presence of dry HCl gas gives α - and β -methyl glucosides because it contains:

- (a) An aldehyde group (b) A – CH_2OH group
(c) A ring structure (d) Five hydroxyl groups

76. When acetylene is passed into methanol at 160200°C in the presence of a small amount of potassium methoxide under pressure, the following is formed -

- (a) Polyvinyl alcohol (b) Divinyl ether
(c) Dimethyl ether (d) Methyl vinyl ether

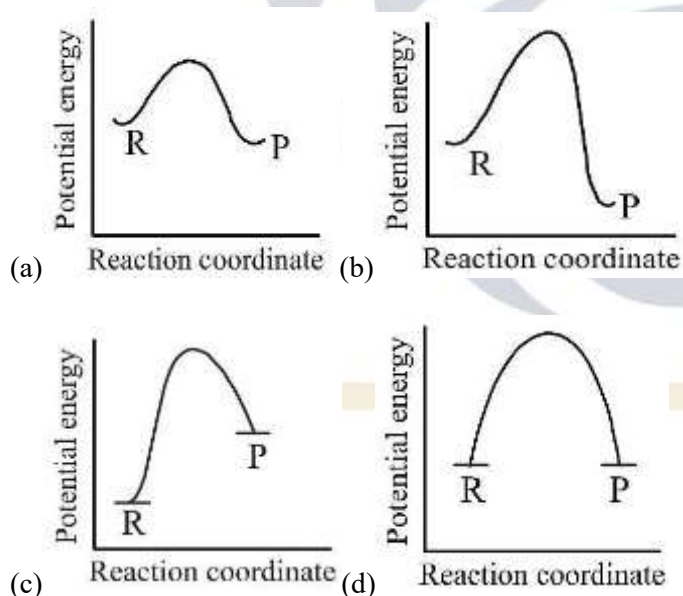
77. Which compound can exist in a dipolar (zwitter ion) state ?

- (a) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}(\text{N}=\text{CH}_2)\text{COOH}$
(b) $(\text{CH}_3)_2\text{CH}.\text{CH}(\text{NH}_2)\text{COOH}$
(c) $\text{C}_6\text{H}_5\text{CONHCH}_2\text{COOH}$
(d) $\text{HOOC}.\text{CH}_2\text{CH}_2\text{COCOCH}_2\text{COOH}$

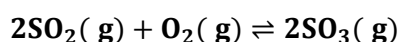
78. A coordination complex compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution; on reacting with excess of AgNO_3 , AgCl is precipitated. The ionic formula for this complex would be:

- (a) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$
(b) $[\text{Co}(\text{NH}_3)_5\text{Cl}][\text{Cl}(\text{NO}_2)]$
(c) $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)\text{Cl}][(\text{NH}_3)\text{Cl}]$
(d) $[\text{Co}(\text{NH}_3)_5][\text{NO}_2)_2\text{Cl}_2]$

79. An endothermic reaction with high activation energy for the forward reaction is given by the diagram.



80. The volume of a closed reaction vessel in which the following equilibrium reaction occurs is halved:



As a result,

- (a) The rates of forward and backward reactions will remain the same.

- (b) The equilibrium will not shift.
- (c) The equilibrium will shift to the right.
- (d) The rate of forward reaction will become double that of reverse reaction and the equilibrium will shift to the right.

PART-III MATHEMATICS

81. If $\tan \theta = \sqrt{n}$ for some non-square natural number n , then $\sec 2\theta$ is:

- (a) a rational number (b) an irrational number
- (c) a positive number (d) none of the above

82. If $z = x + iy$, $z^{1/3} = a - ib$, then $\frac{x}{a} - \frac{y}{b} = k(a^2 - b^2)$ where k is equal to

- (a) 1 (b) 2
- (c) 3 (d) 4

83. If the coordinates at one end of a diameter of the circle $x^2 + y^2 - 8x - 4y + c = 0$ are $(-3, 2)$, then the coordinates at the other end are

- (a) (5, 3) (b) (6, 2)
- (c) (1, -8) (d) (11, 2)

84. The system of linear equations: $x + y + z = 0$, $2x + y - z = 0$, $3x + 2y = 0$ has:

- (a) no solution (b) a unique solution
- (c) an infinitely many solution (d) None of these

85. If $\omega = \frac{-1 + \sqrt{3}i}{2}$ then $(3 + \omega + 3\omega^2)^4$ is

- (a) 16 (b) -16
- (c) 16ω (d) $16\omega^2$

86. If the lines $3x - 4y + 4 = 0$ and $6x - 8y - 7 = 0$ are tangents to a circle, then radius of the circle is

- (a) $\frac{3}{4}$ (b) $\frac{2}{3}$
- (c) $\frac{1}{4}$ (d) $\frac{5}{2}$

87. The position vector of A and B are $2\hat{i} + 2\hat{j} + \hat{k}$ and $2\hat{i} + 4\hat{j} + 4\hat{k}$

The length of the internal bisector of $\angle BOA$ of triangle AOB is

- (a) $\sqrt{\frac{136}{9}}$ (b) $\frac{\sqrt{136}}{9}$
- (c) $\frac{20}{3}$ (d) $\sqrt{\frac{217}{9}}$

88. If $y = \tan^{-1} \frac{4x}{1+5x^2} + \tan^{-1} \frac{2+3x}{3-2x}$, then $\frac{dy}{dx} =$

- (a) $\frac{1}{1+25x^2} + \frac{2}{1+x^2}$ (b) $\frac{5}{1+25x^2} + \frac{2}{1+x^2}$
- (c) $\frac{5}{1+25x^2}$ (d) $\frac{1}{1+25x^2}$

89. If $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ and $B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$, then AB is equal to

- (a) B (b) A
- (c) O (d) I

90. A circle has radius 3 and its centre lies on the line $y = x - 1$. The equation of the circle, if it passes through $(7, 3)$, is

(a) $x^2 + y^2 + 8x - 6y + 16 = 0$

(b) $x^2 + y^2 - 8x + 6y + 16 = 0$

(c) $x^2 + y^2 - 8x - 6y - 16 = 0$

(d) $x^2 + y^2 - 8x - 6y + 16 = 0$

91. At how many points between the interval $(-\infty, \infty)$ is the function $f(x) = \sin x$ is not differentiable.

(a) 0 (b) 7

(c) 9 (d) 3

92. If vector equation of the line

$$\frac{x-2}{2} = \frac{2y-5}{-3} = z + 1, \text{ is}$$

$$\vec{r} = \left(2\hat{i} + \frac{5}{2}\hat{j} - \hat{k}\right) + \lambda\left(2\hat{i} - \frac{3}{2}\hat{j} + p\hat{k}\right) \text{ then } p \text{ is}$$

equal to

(a) 0 (b) 1

(c) 2 (d) 3

93. Evaluate $\lim_{x \rightarrow 2} \frac{\sqrt{(x+7)} - 3\sqrt{(2x-3)}}{\sqrt{(x+6)} - 2\sqrt{(3x-5)}}$

(a) $\frac{17}{9}$

(b) $\frac{17}{18}$

(c) $\frac{34}{23}$

(d) $\frac{26}{7}$

94. The radius of a right circular cylinder increases at the rate of 0.1 cm/min, and the height decreases at the rate of 0.2 cm/min. The rate of change of the volume of the cylinder, in cm^3/min , when the radius is 2 cm and the height is 3 cm is

(a) -2π

(b) $-\frac{8\pi}{5}$

(c) $-\frac{3\pi}{5}$

(d) $\frac{2\pi}{5}$

95. If a, b, c are in A. P., then the value of $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}$ is:

(a) 3

(b) -3

(c) 0

(d) None of these

96. The solution of $\sin x = -\frac{\sqrt{3}}{2}$ is

(a) $x = n\pi + (-1)^n \frac{4\pi}{3}$, where $n \in \mathbb{Z}$

(b) $x = n\pi + (-1)^n \frac{2\pi}{3}$, where $n \in \mathbb{Z}$

(c) $x = n\pi + (-1)^n \frac{3\pi}{3}$, where $n \in \mathbb{Z}$

(d) None of the these

97. The equation $y^2 + 3 = 2(2x + y)$ represents a parabola with the vertex at

(a) $\left(\frac{1}{2}, 1\right)$ and axis parallel to y-axis

(b) $\left(1, \frac{1}{2}\right)$ and axis parallel to x-axis

(c) $\left(\frac{1}{2}, 1\right)$ and focus at $\left(\frac{3}{2}, 1\right)$

(d) $\left(1, \frac{1}{2}\right)$ and focus at $\left(\frac{3}{2}, 1\right)$

98. If $\sin y = x \sin(a + y)$, then $\frac{dy}{dx}$ is equal to:

(a) $\frac{\sin \sqrt{a}}{\sin(a+y)}$

(b) $\frac{\sin^2(a+y)}{\sin a}$

(c) $\sin(a + y)$

(d) None of these

99. $\int (27e^{9x} + e^{12x})^{1/3} dx$ is equal to

(a) $(1/4)(27 + e^{3x})^{1/3} + C$

(b) $(1/4)(27 + e^{3x})^{2/3} + C$

(c) $(1/3)(27 + e^{3x})^{4/3} + C$

(d) $(1/4)(27 + e^{3x})^{4/3} + C$

100. The area under the curve $y = |\cos x - \sin x|$, $0 \leq x \leq \frac{\pi}{2}$, and above x-axis is :

(a) $2\sqrt{2}$

(b) $2\sqrt{2} - 2$

(c) $2\sqrt{2} + 2$

(d) 0

101. The conic represented by $x = 2(\cos t + \sin t)$, $y = 5(\cos t - \sin t)$ is

(a) a circle

(b) a parabola

(c) an ellipse

(d) a hyperbola

102. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 676$ and $|\vec{b}| = 2$, then $|\vec{a}|$ is equal to

(a) 13

(b) 26

(c) 39

(d) None of these

103. The equation of the plane which bisects the angle between the planes $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$ which contains the origin is

(a) $33x - 13y + 32z + 45 = 0$

(b) $x - 3y + z - 5 = 0$

(c) $33x + 13y + 32z + 45 = 0$

(d) None of these

104. A wire 34 cm long is to be bent in the form of a quadrilateral of which each angle is 90° . What is the maximum area which can be enclosed inside the quadrilateral?

(a) 68 cm^2

(b) 70 cm^2

(c) 71.25 cm^2

(d) 72.25 cm^2

105. If $\int \frac{\sin x}{\sin(x-\alpha)} dx = Ax + B \log \sin(x-\alpha) + C$, then value of (A, B) is

(a) $(-\cos \alpha, \sin \alpha)$

(b) $(\cos \alpha, \sin \alpha)$

(c) $(-\sin \alpha, \cos \alpha)$

(d) $(\sin \alpha, \cos \alpha)$

106. The equation of the chord of the hyperbola $25x^2 - 16y^2 = 400$ that is bisected at point (5, 3) is:

(a) $135x - 48y = 481$

(b) $125x - 48y = 48$

(c) $125x - 4y = 48$

(d) None of these

107. Value of $\int_{\pi/6}^{\pi/3} \frac{1}{1+\sqrt{\cot x}} dx$ is

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{12}$
(c) $\frac{12}{\pi}$ (d) None of these

108. The domain of the function $f(x) = \sqrt{\frac{1}{|x-2|-(x-2)}}$ is:

- (a) $(-\infty, 2]$ (b) $(2, \infty)$
(c) $(-\infty, 2)$ (d) $[2, \infty)$

109. Six identical coins are arranged in a row. The number of ways in which the number of tails is equal to the number of heads is

- (a) 20 (b) 9
(c) 120 (d) 40

110. Let f be the function defined by

$$f(x) = \begin{cases} \frac{x^2 - 1}{x^2 - 2|x - 1| - 1}, & x \neq 1 \\ 1/2, & x = 1 \end{cases}$$

- (a) The function is continuous for all values of x
(b) The function is continuous only for $x > 1$
(c) The function is continuous at $x = 1$
(d) The function is not continuous at $x = 1$ $(-\infty, \infty)$,

111. If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$,

- (a) $f(x)$ is a strictly increasing function
(b) $f(x)$ has local maxima
(c) $f(x)$ is a strictly decreasing function
(d) $f(x)$ is bounded

112. The solution of the differential equation

$$\{1 + x\sqrt{(x^2 + y^2)}\} dx + \{\sqrt{(x^2 + y^2)} - 1\} y dy = 0 \text{ is}$$

- (a) $x^2 + \frac{y^2}{2} + \frac{1}{3}(x^2 + y^2)^{3/2} = C$
(b) $x - \frac{y^2}{3} + \frac{1}{2}(x^2 + y^2)^{1/2} = C$
(c) $x - \frac{y^2}{2} + \frac{1}{3}(x^2 + y^2)^{3/2} = C$
(d) None of these

113. The integrating factor of $\frac{xdy}{dx} - y = x^4 - 3x$ is

- (a) x (b) $\log x$
(c) $\frac{1}{x}$ (d) $-x$

114. It is given that the events A and B are such that $P(A) = \frac{1}{4}$, $P(A | B) = \frac{1}{2}$ and $P(B | A) = \frac{2}{3}$. Then $P(B)$ is

- (a) $\frac{1}{6}$ (b) $\frac{1}{3}$
(c) $\frac{2}{3}$ (d) $\frac{1}{2}$

115. Let $f: \mathbb{R} \rightarrow \mathbb{R}, g: \mathbb{R} \rightarrow \mathbb{R}$ be two functions such that

$f(x) = 2x - 3, g(x) = x^3 + 5$. The function $(f \circ g)^{-1}(x)$ is equal to

- (a) $\left(\frac{x+7}{2}\right)^{1/3}$ (b) $\left(x - \frac{7}{2}\right)^{1/3}$
(c) $\left(\frac{x-2}{7}\right)^{1/3}$ (d) $\left(\frac{x-7}{2}\right)^{1/3}$

116. The inverse of the statement $(p \wedge \sim q) \rightarrow r$ is

- (a) $\sim (p \vee \sim q) \rightarrow \sim r$ (b) $(\sim p \wedge q) \rightarrow \sim r$
(c) $(\sim p \vee q) \rightarrow \sim r$ (d) None of these

117. The value of x in the interval $[4, 9]$ at which the function $f(x) = \sqrt{x}$ satisfies the mean value theorem is

- (a) $\frac{13}{4}$ (b) $\frac{17}{4}$
(c) $\frac{21}{4}$ (d) $\frac{25}{4}$

118. The value of the integral $\int_{-1}^3 (|x| + |x - 1|) dx$ is

- (a) 4 (b) 9
(c) 2 (d) $\frac{9}{2}$

119. Let a, b, c , be in A.P. with a common difference d . Then $e^{1/c}, e^{b/ac}, e^{1/a}$ are in :

- (a) G.P. with common ratio e^d
(b) G.P with common ratio $e^{1/d}$
(c) G.P. with common ratio $e^{d/(b^2-d^2)}$
(d) A.P.

120. If the second term in the expansion $\left(\sqrt[13]{a} + \frac{a}{\sqrt{a-1}}\right)^n$ is $14a^{5/2}$, then $\frac{{}^nC_3}{{}^nC_2} =$

- (a) 4 (b) 3
(c) 12 (d) 6

PART-IV ENGLISH

121. In the given sentence, find out which part has an error. The letter of that part will be your answer. If there is no error, mark (d) as your answer.

She is a brilliant teacher

- (a)/ but of her three children (b)/ neither has any merit. (c)/ No error (d)

122. Find the synonym of the word IMPECCABLE

- (a) Remarkable (b) Unbelievable
(c) Flawless (d) Displeasing

123. Find the antonym of the word AMELIORATE

- (a) Improve (b) Depend
(c) Soften (d) Worsen

124. Find the meaning of the given idiom A bolt from the blue

- (a) An unpleasant event
(b) An inexplicable event
(c) A delayed event
(d) An unexpected event

125. Read the passage and answer the given question There seems to be no chilly distance existing between the German students and the professor, but, on the contrary, a companionable intercourse, the opposite of chilliness and reserve. When the professor enters a beer hall in the evening where students are gathered together, these rise up and take off their caps and invite the old gentleman to sit with them and partake. He accepts, and the pleasant talk and the beer flow for an hour or two, and by and by the professor, properly charged and comfortable, gives a cordial good night, while the students stand bowing and uncovered, and then he moves on his happy way homeward with all his vast cargo of learning afloat in his hold. Nobody finds fault or feels outraged. No harm has been done.

What does the author mean by the phrase 'no chilly distance'?

- (a) Professor's home is not very far from the beer hall.
- (b) Students and the professor are very friendly with each other.
- (c) The weather is not very chilly in Germany.
- (d) The professor being very strict scares the students quite a few times as in the beer hall.

