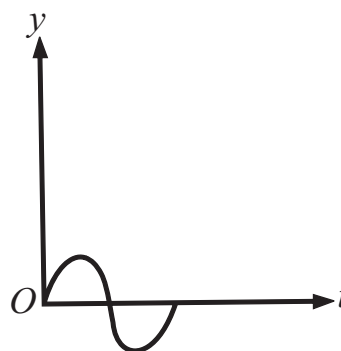


PHYSICS

- | | |
|--|--|
| <p>1. Out of the following four dimensional quantities, which one qualifies to be called a dimensional constant?
 (a) Acceleration due to gravity
 (b) Surface tension of water
 (c) Weight of a standard kilogram mass
 (d) The velocity of light in vacuum</p> <p>2. What is the dimension of a in van der Waals' equation?
 (a) $[ML^{-1}T^{-2}]$ (b) $[ML^5T^{-2}]$
 (c) $[ML^3T^{-3}]$ (d) $[ML^3T^{-2}]$</p> <p>3. A car starts from rest and accelerates uniformly to a speed of 180 km/h in 10 s. The distance covered by the car in this interval is
 (a) 500 m (b) 250 m
 (c) 100 m (d) 200 m</p> <p>4. A stone is thrown vertically upwards. When the stone is at a height equal to half its maximum height, its speed will be 10 m/s, then the maximum height attained by the stone is (take $g=10 \text{ m/s}^2$)
 (a) 5 m (b) 150 m
 (c) 20 m (d) 10 m</p> <p>5. A cubical block rests on an inclined plane of coefficient of friction $\mu=1/\sqrt{3}$. what should be the angle of inclination so that the block just slides down the inclined plane?
 (a) 30° (b) 60°
 (c) 45° (d) 90°</p> <p>6. A body of mass 10 kg is lying on a rough plane inclined at angle of 30° to the horizontal and the coefficient of a friction is 0.5. The minimum force required to pull the body up the plane is
 (a) 914 N (b) 91.4 N
 (c) 9.14 (d) 0.914 N</p> | <p>7. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 ms^{-1}. The kinetic energy of the other mass is
 (a) 256 J (b) 486 J
 (c) 524 J (d) 324</p> <p>8. An electron with kinetic energy 5 eV is inclined on a H-atom in its ground state. The collision
 (a) must be elastic
 (b) may be partially elastic
 (c) may be completely elastic
 (d) may be completely inelastic</p> <p>9. A body of mass M moves with velocity v and collides elastically with another body of mass m ($M \gg m$) at rest, then the velocity of body of mass m is
 (a) v (b) $2v$
 (c) $v/2$ (d) zero</p> <p>10. At any instant, a rolling body may be considered to be in pure rotation about an axis through the point of contact. This axis is translating forward with speed
 (a) equal to centre of mass
 (b) zero
 (c) twice of centre of mass
 (d) no sufficient data</p> <p>11. When earth moves round the sun, the quantity which remains constant is
 (a) angular velocity
 (b) kinetic energy
 (c) potential energy
 (d) areal velocity</p> <p>12. A satellite moves in a circle around the earth. The radius of this circle is equal to one-half of the radius of the moon's orbit. The satellite completes one revolution in
 (a) $1/2$ lunar month
 (b) $2/3$ lunar month
 (c) $2^{-3/2}$ lunar month
 (d) $2^{3/2}$ lunar month</p> |
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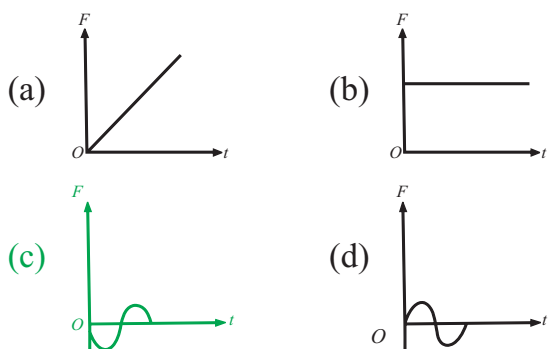
SPACE FOR ROUGH WORK

13. An iron rod of length 2m and cross-sectional area of 50 mm^2 is stretched by 0.5 mm, when mass of 250 kg is hung from its lower end. Young's modulus of iron rod is
 (a) $19.6 \times 10^{20} \text{ Nm}^{-2}$ (b) $19.6 \times 10^{18} \text{ Nm}^{-2}$
 (c) $19.6 \times 10^{10} \text{ Nm}^{-2}$ (d) $19.6 \times 10^{15} \text{ Nm}^{-2}$
14. According to Hooke's law of elasticity, if stress is increased, then the ratio of stress to strain
 (a) becomes zero
 (b) remains constant
 (c) decreases
 (d) increases
15. The temperature of the black body increases from T to $2T$. The factor by which the rate of emission will increase, is
 (a) 4 (b) 2
 (c) 16 (d) 8
16. A black body at 200 k is found to emit maximum energy at a wavelength $14 \mu\text{m}$. When its temperature is raised to 1000 k, then wavelength at which maximum energy emitted is
 (a) 14 mm (b) $7 \mu\text{m}$
 (c) $2.8 \mu\text{m}$ (d) 28mm
17. The absolute temperature of a body A is four times that of another body B. For the two bodies, the difference in wavelengths, at which energy radiated is maximum is $3 \mu\text{m}$. Then, the wavelength, at which the body B radiates maximum energy, in micrometer, is
 (a) 2 (b) 2.5 (c) 4.00 (d) 4.5
18. Pressure of an ideal gas is increased by keeping temperature constant. What is the effect on kinetic energy of molecules?
 (a) Increase
 (b) Decrease
 (c) No change
 (d) Can't be determined
19. A closed vessel is maintained at a constant temperature. It is first evacuated and then vapour is injected into it continuously. The pressure of the vapour in the vessel
 (a) increases continuously
 (b) first increases and then remains constant
 (c) first increases and then decreases
 (d) None of the above
20. Some gas at 300 k is enclosed in a container. Now, the container is placed on a fast moving train. While the train is in motion, the temperature of the gas
 (a) rises above 300 k
 (b) falls below 300 k
 (c) remains unchanged
 (d) becomes unsteady
21. The displacement of a particle from its mean position (in metre) is given by $Y = 0.2 \sin(10\pi t + 1.5\pi) \cos(10\pi t + 1.5\pi)$
 The motion of the particle is
 (a) periodic but not SHM
 (b) non periodic
 (c) simple harmonic motion with period 0.1 s
 (d) simple harmonic motion with period 0.2 s
22. The displacement-time graph of a particle executing SHM is as shown in the figure.



The corresponding force-time graph of the particle is

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23. A particle executes SHM, its time period is 16 s. If it passes through the centre of oscillation then its velocity is 2 ms^{-1} at times 2 s. the amplitude will be

(a) 7.2 m (b) 4 cm
(c) 6 cm (d) 0.72m

24. Two equal $-ve$ charge $-q$ are fixed at the point $(0, a)$ and $(0, -a)$ on the y -axis. A positive charge Q is released from rest at the point $(2a, 0)$ on the x -axis. The charge will

(a) execute SHM about the origin
(b) move to the origin and remain at rest
(c) move to infinite
(d) execute oscillatory but not SHM

25. Charges $4Q$, q and Q are placed along x -axis at position $x=0$, $x=1/2$ and $x=1$, respectively. Find the value of q , so that force on charge Q is zero.

(a) Q (b) $Q/2$
(c) $-Q/2$ (d) $-Q$

26. Four metal conductors having different shapes

1. a sphere 2. cylinder
3. pear 4. lighting conductor

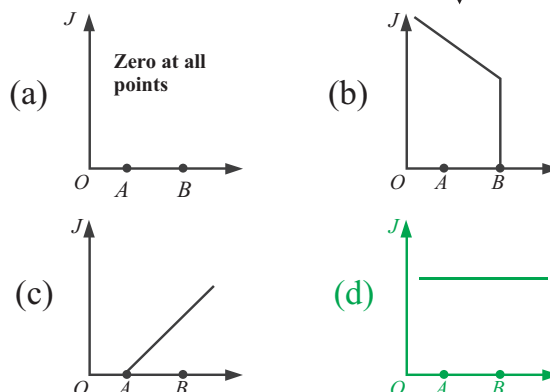
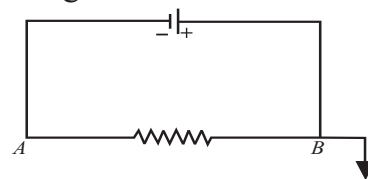
are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

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

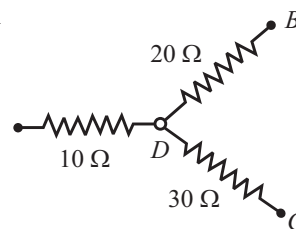
27. Electric field and current density have relation

(a) $E \propto J$ (b) $E \propto 1/J$
(c) $E \propto 1/J^2$ (d) $E^2 \propto 1/J$

28. A battery is connected to a uniform resistance wire AB and B is earthed. Which one of the following graphs below shows how the current density J varies along AB ?

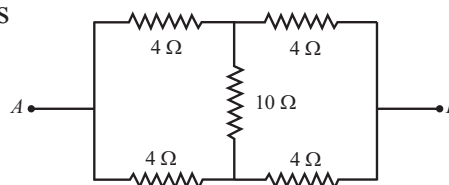


29. In the circuit given here, the points A, B and C are 70 V , zero, 10 V respectively. Then



- (a) the point D will be at a potential of 60 V
(b) the point D will be at a potential of 20 V
(c) current in the paths AD, BD and DC are in the ratio of $1:2:3$
(d) currents in the paths AB, DB and DC are in the ratio of $3:2:1$

30. The equivalent resistance across A and B is



(a) 2Ω (b) 3Ω
(c) 4Ω (d) 5Ω

SPACE FOR ROUGH WORK

31. In which type of material the magnetic susceptibility does not depend on temperature?
 (a) Diamagnetic (b) paramagnetic
 (c) Ferromagnetic (d) Ferrite
32. A diamagnetic material in a magnetic field moves
 (a) perpendicular to the field
 (b) from weaker to the stronger part of the field
 (c) from stronger to the weaker parts of the field
 (d) in none of the above directions
33. Curie-Weiss law is obeyed by iron
 (a) at Curie temperature only
 (b) at all temperatures
 (c) below curie temperatures
 (d) above curie temperatures
34. In a transformer, number of turns in the primary coil are 140 and that in the secondary coil are 280. If current in primary coil is 4A, then that in the secondary coil is
 (a) 4A (b) 2A
 (c) 6A (d) 10A
35. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon
 (a) the rates of the which currents are changing in the two coil
 (b) relative position and orientation of the two coils
 (c) the materials of the wires of the coils
 (d) the currents in the two coils
36. Alternating current can't be measured by D.C. ammeter because
 (a) Average value of current for complete cycle is zero
 (b) A.C Changes direction
 (c) A.C. can't pass through D.C. Ammeter
 (d) D.C. Ammeter will get damaged
37. A plane electromagnetic wave propagation in the X-direction has wavelength of 6.0mm. The electric field is in the Y-direction and its maximum magnitude of 33 Vm^{-1} . The equation for the electric field as function of x and t is
 (a) $11 \sin \pi(t-x/c)$
 (b) $33 \sin \pi \times 10^{11}(t-x/c)$
 (c) $33 \sin \pi(t-x/c)$
 (d) $11 \sin \pi \times 10^{11}(t-x/c)$
38. Which of the following statement is false for the properties of electromagnetic waves?
 (a) Both electric and magnetic field vectors attain the maxima and minima at the same place and the same time.
 (b) The energy in electromagnetic waves is divided equally between electric and magnetic vectors
 (c) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave.
 (d) These waves do not require any material medium for propagation.
39. Which one of the following is the property of monochromatic, plane electromagnetic waves in free space?
 (a) Electric and magnetic fields have a phase difference of $\pi/2$
 (b) The energy contribution of both electric and magnetic fields are equal.
 (c) The direction of the propagation in the direction of $\mathbf{B} \times \mathbf{E}$
 (d) The pressure exerted by the wave is the product of its speed and energy density
40. A Single slit is located effectively at infinity in front of a lens of focal length 1m and it is illuminated normally with light of wavelength 600 nm. The first minima on either side of central maximum are separated by 4 mm. Width of slit is

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- (a) 0.1 mm (b) 0.2 mm
(c) 0.3 mm (d) 0.4 mm

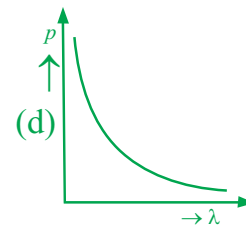
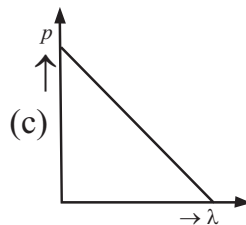
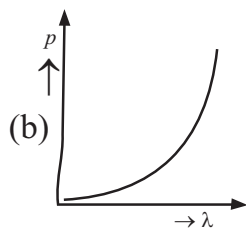
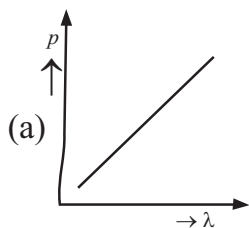
41. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness $2 \mu\text{m}$ and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maxima will
(a) remain unshifted
(b) shift downward by nearly two fringes
(c) shift upward by nearly two fringes
(d) shift downward by ten fringes

42. A light of wavelength 5890 \AA falls normally of a thin air film. The minimum thickness of the film such that the film appears dark in the reflected light
(a) $2.945 \times 10^{-7} \text{ m}$ (b) $3.945 \times 10^{-7} \text{ m}$
(c) $4.95 \times 10^{-7} \text{ m}$ (d) $1.945 \times 10^{-7} \text{ m}$

43. In an interference experiment, third bright fringe is obtained at point on the screen with a light of 700 nm. What should be the wavelength of the light source in order to obtained 5th bright fringe at the same point?
(a) 630 nm (b) 500 nm
(c) 420 nm (d) 750 nm

44. If alpha, beta and gamma rays carry same momentum, which has the longest wavelength?
(a) Alfa rays
(b) Beta rays
(c) Gamma rays
(d) None, all have same wavelength

45. Which of the following figures represent the variation of a particle momentum and associated de-Broglie wavelength?



46. In the davission and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by
(a) increasing the filament current
(b) decreasing the filament current
(c) decreasing the potential difference between the anode and filament
(d) increasing the potential difference between the anode and filament

47. An electron jumps from the first excited state to the ground state of hydrogen atom. What will the percentage change in the speed of electron?
(a) 25% (b) 50%
(c) 100% (d) 200%

48. In hydrogen atom the electron is making $6.6 \times 10^{15} \text{ rev/s}$ around the nucleus of radius 0.53 \AA . The magnetic field produced at the centre of the orbit is nearly
(a) 0.12 Wb/m^2 (b) 1.2 Wb/m^2
(c) 12 Wb/m^2 (d) 120 Wb/m^2

49. In semiconductor the concentration of electron and holes are $8 \times 10^{18} \text{ m}^{-3}$ and $5 \times 10^{18} \text{ m}^{-3}$ respectively. If the mobilities of electrons holes are $2.3 \text{ m}^2 \text{ v}^{-1} \text{ s}^{-1}$ and $0.01 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ respectively, then semiconductor is
(a) n-type and its resistivity is 0.34 O-m
(b) p-type and its resistivity is 0.034 O-m
(c) n-type and its resistivity is 0.034 O-m
(d) p-type and its resistivity is 3.4 O-m

50. The temperature of germanium is decrease from room temperature to 100 K, the resistance of germanium
(a) decrease (b) increase
(c) remains unaffected
(d) depends on external conditions

SPACE FOR ROUGH WORK

CHEMISTRY

51. To dissolve 0.9 g metal, 100 mL of 1 N HCl is used. What is the equivalent weight of metal?
 (a) 7 (b) 9
 (c) 10 (d) 6
52. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenyl amine as indicator. The number of moles of Mohr's salt require per mole of dichromate is?
 (a) 3 (b) 4
 (c) 5 (d) 6
53. The quantum numbers $+\frac{1}{2}$ and $-\frac{1}{2}$ for the electron spin represent
 (a) rotation of the electron in clockwise and anticlockwise direction respectively
 (b) rotation of the electron in anticlockwise and clockwise direction respectively
 (c) magnetic moment of the electron pointing up and down respectively
 (d) two quantum mechanical spin states which have no classical analogue
54. The total number of electrons present in all the 's' orbitals, all the 'p' orbitals and all the 'd' orbitals of cesium ion are respectively
 (a) 8, 26, 10 (b) 10, 24, 20
 (c) 8, 22, 24 (d) 12, 20, 22
55. Amongst the elements with following electronic configurations which one of them may have the highest ionization energy?
 (a) $[\text{Ne}]3s^23p^3$ (b) $[\text{Ne}]3s^23p^2$
 (c) $[\text{Ar}]3d^{10}4s^24p^3$ (d) $[\text{Ne}]3s^23p^1$
56. Among the following the electron deficient compound is:
 (a) BCl_3 (b) CCl_4
 (c) PCl_5 (d) BeCl_2
57. In which of the following molecules / ions BF_3 , NO_2^- , NH_2^- and H_2O the central atom is sp^2 hybridized?
 (a) NH_2^- and H_2O (b) NO_2^- and H_2O
 (c) BF_3 and NO_2^- (d) NO_2^- and NH_2^-
58. Which one of the following is an exothermic reaction?
 (a) $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) + 180.8 \text{ kJ} \rightarrow 2\text{NO}(\text{g})$
 (b) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) - 92 \text{ kJ} \rightarrow 2\text{NH}_3(\text{g})$
 (c) $\text{C}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2(\text{g}) - 131.1 \text{ kJ}$
 (d) $\text{C}(\text{graphite}) + 2\text{S}(\text{s}) \rightarrow \text{CS}_2(\text{l}) + 91.9 \text{ kJ}$
59. Which of the reaction defines ΔH_f° ?
 (a) $\text{C}(\text{diamond}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
 (b) $\frac{1}{2} \text{H}_2(\text{g}) + \frac{1}{2} \text{F}_2(\text{g}) \rightarrow \text{HF}(\text{g})$
 (c) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
 (d) $\text{CO}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
60. Which of the following equations correctly represents the standard heat of formation (ΔH_f°) of methane?
 (a) $\text{C}(\text{diamond}) + 4\text{H}(\text{g}) \rightarrow \text{CH}_4(\text{g})$
 (b) $\text{C}(\text{diamond}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g})$
 (c) $\text{C}(\text{graphite}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g})$
 (d) $\text{C}(\text{graphite}) + 4\text{H}(\text{g}) \rightarrow \text{CH}_4(\text{g})$
61. The Henry's law constant for the solubility of N_2 gas in water at 298K is 1.0×10^5 atm. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water 298 k and 5 atm pressure is
 (a) 4.0×10^{-4} (b) 4.0×10^{-5}
 (c) 5.0×10^{-4} (d) 4.0×10^{-6}

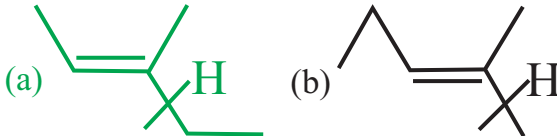
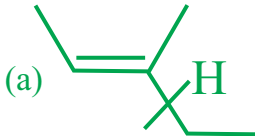
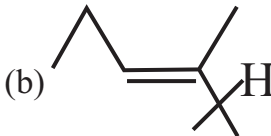
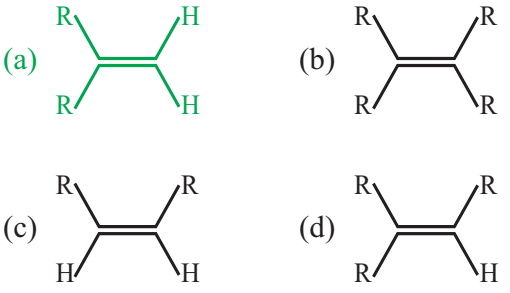
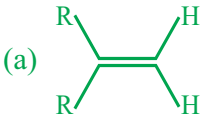
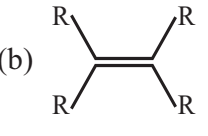
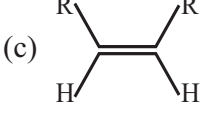
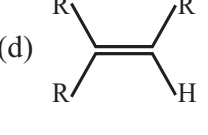
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62. Volume of water needed to mix with 10 mL NHCl to get 0.1 N HCl is
 (a) 900 mL (b) 9 mL
 (c) 90 mL (d) 100 mL
63. Four moles of PCl_5 are heated in a closed 4 dm³ container to reach equilibrium at 400K. At equilibrium 50 % of PCl_5 is dissociated. What is the value of K_c for the dissociation of PCl_5 into PCl_3 and Cl_2 at 400 K?
 (a) 0.50 (b) 1.00 (c) 1.15 (d) 0.05
64. The ionization of strong electrolytes in acetic acid, compared to in water, is
 (a) weak, low
 (b) strong, more
 (c) medium, the same
 (d) no ionization, 100%
65. In permonosulphuric acid (H_2SO_5), the oxidation number of sulphur is
 (a) +8 (b) +4
 (c) +5 (d) +6
66. What is the oxidation number of chlorine in ClO_3^- ?
 (a) +5 (b) +3
 (c) +4 (d) +2
67. In which of the following reactions, hydrogen is acting as an oxidation agent?
 (a) with Li to form LiH
 (b) with I_2 to give HI
 (c) with S to give H_2S
 (d) None of the above
68. Consider an endothermic reaction $\text{X} \rightarrow \text{Y}$ with the activation energies E_b and E_f for the backward and forward reactions respectively. In general
 (a) there is no definite relation between E_b and E_f
 (b) $E_b = E_f$
 (c) $E_b > E_f$
 (d) $E_b < E_f$
69. The phenomenon of emission of visible light as result of chemical change is known as
 (a) chemiluminescence
 (b) fluorescence
 (c) phosphorescence
 (d) photosensitization
70. The rate of reaction is doubled when temperature increase by 10°C. If temperature is increased by 100°C, then rate of reaction will become
 (a) 64 times (b) 256 times
 (c) 512 times (d) 1024 times
71. Rate of physical adsorption increase with
 (a) decrease in temperature
 (b) decrease in pressure
 (c) increase in temperature
 (d) decrease surface area
72. The gas which is least adsorbed on charcoal (under identical condition) is
 (a) HCl (b) O_2
 (c) CO_2 (d) NH_3
73. Variable oxidation state and degenerated orbital shows
 (a) s-block element
 (b) p-block element
 (c) d-block element
 (d) all of these
74. According to the periodic law of elements, the variation of properties of elements is related to their
 (a) atomic masses
 (b) nuclear masses
 (c) atomic number
 (d) nuclear neutron-proton number ratios
75. For making good quality mirrors, plates of float glass are used. These are obtained by floating molten glass over a liquid metal which does not solidify before glass. The metal used can be
 (a) mercury (b) tin
 (c) sodium (d) magnesium

SPACE FOR ROUGH WORK

76. Which of the following statement is wrong?
 (a) The stability of hydrides increase from NH_3 to BiH_3 in group 15 of the periodic Table.
 (b) Nitrogen cannot form $d\pi$ - $p\pi$ bond
 (c) Single N-N bond is weaker than the single P-P bond.
 (d) N_2O_4 has two resonance structure.
77. Hydrogen is prepared on large scale for industrial use
 (a) by $\text{Zn} + \text{H}_2\text{SO}_4$
 (b) by $\text{Al} + \text{NaOH}$
 (c) by $\text{Na} + \text{C}_2\text{H}_5\text{OH}$
 (d) from water gas
78. The most abundant element in the universe is thought to be
 (a) carbon (b) oxygen
 (c) hydrogen (d) nitrogen
79. What happens when carbonates of IA group elements are heated?
 (a) CO_2 is given out
 (b) water vapours are given out
 (c) Carbon dioxide and water vapours are evolved.
 (d) None of the above.
80. Ripening of fruits can be carried out in presence of:
 (a) Na_2SO_4 (b) NaCl
 (c) CaCl_2 (d) CaC_2
81. Hypochlorite disproportionates to give
 (a) Cl^- and ClO_4^- (b) ClO_4^- and ClO_3^-
 (c) ClO_3^- and Cl^- (d) ClO_2^- and Cl^-
82. The reaction that takes place when Cl_2 gas is passed through conc. NaOH solution is
 (a) oxidation
 (b) reduction
 (c) displacement
 (d) disproportionation
83. Hypochlorite disproportionates to give
 (a) Cl^- and ClO_4^-
 (b) ClO_4^- and ClO_3^-
 (c) ClO_3^- and Cl^-
 (d) ClO_2^- and Cl^-
84. Which one of the following metals is give extracted by a carbon reduction process?
 (a) copper (b) Iron
 (c) Aluminium (d) Magnesium
85. Extraction for zinc from zinc blende is achieved by
 (a) electrolytic reduction
 (b) roasting followed by reduction with carbon
 (c) roasting followed by reduction with another metal
 (d) roasting followed by self reduction
86. Which do not decolourise KMnO_4 aqueous solution?
 (a) $\text{C}_2\text{O}_4^{2-}$ (b) HSO_3^-
 (c) CO_3^{2-} (d) SO_3^{2-}
87. The complex showing a spin – only magnetic moment of 2.82 BM is
 (a) $\text{Ni}(\text{CO})_4$ (b) $[\text{NiCl}_4]^{2-}$
 (c) $\text{Ni}(\text{PPh}_3)_4$ (d) $[\text{Ni}(\text{CN})_4]^{2-}$
88. Which one of the following is wrongly matched?
 (a) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ — square planar
 (b) $[\text{Ni}(\text{CO})_4]$ — Neutral ligand
 (c) $[\text{Fe}(\text{CN})_6]^{3-}$ — sp^3d^2
 (d) none of above
89. The spin only magnetic moment value (in Bohr magneton units) of $\text{Cr}(\text{CO})_6$ is
 (a) 0 (b) 2.84
 (c) 4.90 (d) 5.92
90. The smog is essentially caused by the presence of
 (a) O_2 and O_3 (b) O_2 and N_2
 (c) oxides of sulphur and nitrogen
 (d) O_3 and N_2

SPACE FOR ROUGH WORK

91. Which of the following is responsible for the depletion of the ozone layer in the upper strata of the atmosphere?
 (a) Polyhalogens
 (b) Ferrocenes
 (c) Fullerenes
 (d) Freons
92. The number of optically active isomers of tatraic acid are
 (a) 1 (b) 3
 (c) 2 (d) 4
93. Which of the following compounds will show geometrical isomerism?
 (a) Cyclohexene
 (b) 2-hexene
 (c) 3-hexyne
 (d) 1,1-diphenylethylene
94. C_8H_{16} that form cis-trans geometrical isomers and also has a chiral centre, is

 (a)  (b) 
 (c) Both (a) and (b) (d) None of these
95. Which one of the following alkenes will react faster with H_2 under catalytic hydrogenation conditions?
 (R = Alkyl substituent)

 (a)  (b) 
 (c)  (d) 
96. 3-phenylepropene on reaction with HBr gives (as a major product)
 (a) $C_6H_5CH_2CH(Br)CH_3$
 (b) $C_6H_5CH(Br)CH_2CH_3$
 (c) $C_6H_5CH_2CH_2CH_2Br$
 (d) $C_6H_5CH(Br)CH=CH_2$
97. The reaction of primary amine with chloroform and ethanolic solution of KOH is called
 (a) Hofmann's reaction
 (b) Reimer-Tiemann's reaction
 (c) Carbylamine reaction
 (d) Kolbe's reaction
98. During acetylation of amines, what is replaced by acetyl group?
 (a) Hydrogen atom attached to nitrogen atom
 (b) one or more hydrogen atoms attached to carbon atoms
 (c) One or more hydrogen atoms attached to nitrogen atoms
 (d) Hydrogen atoms attached to either carbon atom or nitrogen atom
99. Aniline is prepared in the presence of Fe/HCl from
 (a) benzene (b) nitrobenzene
 (c) dinitrobenzene (d) None of these
100. An aliphatic amine on treatment with alcoholic carbon disulphide and mercuric chloride forms ethyl isothiocyanate, the reaction is known as
 (a) Hofmann's reaction
 (b) Hofmann's rearrangement
 (c) Hofmann's mustard oil reaction
 (d) Hofmann's bromamide degradation reaction

SPACE FOR ROUGH WORK

MATHEMATICS

101. Let $f(x) = |x-1|$. Then
 (a) $f(x^2) = (f(x))^2$ (b) $f(x+y) = f(x) + f(y)$
 (c) $f(|x|) = |f(x)|$ (d) none of these.
102. If $f(x) = \frac{x^2-1}{x^2+1}$, for every real number x , then the minimum value of f ,
 (a) does not exist because f is unbounded
 (b) is not attained even though f is bounded
 (c) is equal to 1
 (d) is equal to -1
103. If the cube roots of unity are $1, \omega, \omega^2$ then the roots of the equation $(x-1)^3 + 8 = 0$ are
 (a) $-1, 1+2\omega, 1+2\omega^2$ (b) $-1, 1-2\omega, 1-2\omega^2$
 (c) $-1, -1, -1$ (d) None of these
104. The smallest +ve integer n for which $\left(\frac{1+i}{1-i}\right)^n = 1$ is :
 (a) 8 (b) 16
 (c) 12 (d) None of these.
105. If z_1, z_2, z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = 1$, $\left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right| = 1$, then $|z_1 + z_2 + z_3|$ is
 (a) equal to 1 (b) less than 1
 (c) greater than 3 (d) equal to 3
106. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$. Then the value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}$
 (a) 3ω (b) $3\omega(\omega-1)$
 (c) $3\omega^2$ (d) $3\omega(1-\omega)$
107. If $\omega (\neq 1)$ is a cube root of unity, then $\begin{vmatrix} 1 & 1+i+\omega^2 & \omega^2 \\ 1-i & -1 & \omega^2-1 \\ -i & -i+\omega-1 & -1 \end{vmatrix}$
 (a) 0 (b) 1 (c) i (d) ω .
108. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, then value of α for which $A^2 = B$, is
 (a) 1 (b) -1
 (c) 4 (d) no real values
109. If $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $|A^3| = 125$ then the value of α is
 (a) ± 1 (b) ± 2
 (c) ± 3 (d) ± 5
110. The number of matrices A in A for which the system $A \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ has a unique solution
 (a) less than 4
 (b) at least 4 but less than 7
 (c) at least 7 but less than 10
 (d) at least 10
111. The coefficient of x^5 in the expansion of $(1+x)^{21} + (1+x)^{22} + \dots + (1+x)^{30}$ is equal to :
 (a) ${}^{51}C_5$ (b) 9C_5
 (c) ${}^{31}C_6 - {}^{21}C_6$ (d) ${}^{30}C_5 + {}^{20}C_5$
112. The term independent of x in the expansion of $(1+x+2x^3) \left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$ is :
 (a) $\frac{7}{18}$ (b) $\frac{2}{27}$
 (c) $\frac{7}{18} + \frac{2}{27}$ (d) $\frac{7}{18} - \frac{2}{27}$
113. If the coefficient of x^7 and x^8 in $\left(2 + \frac{x}{3}\right)^n$ are equal then n is :
 (a) 56 (b) 55 (c) 45 (d) 15

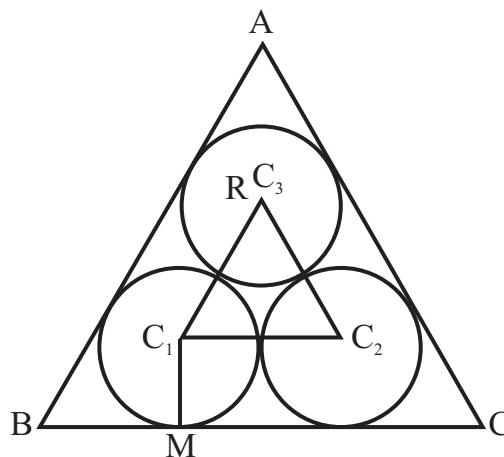
SPACE FOR ROUGH WORK

114. The coefficient of x^4 in the expansion of $(1+x+x^2+x^3)^n$ is :
 (a) ${}^n C_4 + {}^n C_2 + {}^n C_1$
 (b) ${}^n C_4 + {}^n C_2 + {}^n C_1 + {}^n C_2$
 (c) ${}^n C_4 + {}^n C_2$
 (d) none of the above
115. The coefficient of x^4 in $\left(\frac{3}{2} - \frac{3}{x^2}\right)^{10}$ is
 (a) $\frac{405}{256}$ (b) $\frac{504}{259}$
 (c) $\frac{450}{263}$ (d) none of these
116. If in the expression of $(1+x)^m (1-x)^n$, the coefficient of x and x^2 are 3 and -6 respectively then m is
 (a) 6 (b) 9 (c) 12 (d) 24
117. Coefficient of t^{24} in $(1+t^2)^{12} (1+t^{12}) (1+t^{24})$ is
 (a) ${}^{12} C_6 + 3$ (b) ${}^{12} C_6 + 1$
 (c) ${}^{12} C_6$ (d) ${}^{12} C_6 + 2$
118. Given positive integers $r > 1$, $n > 2$ and the coeff. of $(3r)^{\text{th}}$ and $(r+2)^{\text{th}}$ terms in the binomial expansion of $(1+x)^{2n}$ are equal. Then
 (a) $n = 2r$ (b) $n = 2r+1$
 (c) $n = 3r$ (d) none of these
119. $\lim_{x \rightarrow 0} \frac{x^3 \cot x}{1 - \cos x} =$
 (a) 0 (b) 1
 (c) 2 (d) -2
120. If $f(x) = \begin{cases} x, & \text{when } 0 \leq x \leq 1 \\ 2-x, & \text{when } 1 < x \leq 2 \end{cases}$, then $\lim_{x \rightarrow 1} f(x) =$
 (a) 1 (b) 2
 (c) 0 (d) Does not exist
121. If the derivative of the function $f(x)$ is every where continuous and is given by
- $$f(x) = \begin{cases} bx^2 + ax + 4; & x \geq -1 \\ ax^2 + b & ; x < -1 \end{cases}$$
- (a) $a=2, b=3$ (b) $a=3, b=2$
 (c) $a=-2, b=-3$ (d) $a=-3, b=-2$
122. If $f(x) = |x|$, then $f(x)$ is
 (a) Continuous for all x
 (b) Differentiable at $x=0$
 (c) Neither continuous nor differentiable at $x=0$
 (d) None of these
123. If ${}^{28} C_{2p} = {}^{24} C_{2p-4}$ then :
 (a) $p = 24$ (b) $p = 7$
 (c) $p = 14$ (d) none of these
124. How many even numbers be formed by using all the digits 2, 3, 4, 5, 6?
 (a) 48 (b) 24
 (c) 120 (d) 72
125. The number of ways in which a team of eleven players can be selected from 22 players including 2 of them and excluding 4 of them is :
 (a) ${}^{16} C_{11}$ (b) ${}^{16} C_5$
 (c) ${}^{16} C_9$ (d) ${}^{20} C_9$
126. The number of times the digit 5 will be written when listing the integers from 1 to 1000 is :
 (a) 271 (b) 272
 (c) 300 (d) none of these
127. $\int \sqrt{1 - \sin 2x} \, dx = \dots, x \in (0, \pi/4)$
 (a) $-\sin x + \cos x$ (b) $\sin x - \cos x$
 (c) $\tan x + \sec x$ (d) $\sin x + \cos x$
128. $\int \frac{1 + \cos^2 x}{\sin^2 x} \, dx =$
 (a) $-\cot x - 2x + c$ (b) $-2\cot x - 2x + c$
 (c) $-2\cot x - x + c$ (d) $-2\cot x + x + c$
129. $\int \sqrt{1+x^2} \, dx =$
 (a) $\frac{x}{2} \sqrt{1+x^2} + \frac{1}{2} \log(x + \sqrt{1+x^2}) + c$

- (b) $\frac{3}{2} (1+x^2)^{3/2} + c$
 (c) $\frac{2}{3} x(1+x^2)^{3/2} + c$
 (d) None of these
130. $\int \sqrt{\frac{e^x+a}{e^x-a}} dx =$
 (a) $\cosh^{-1}\left(\frac{e^x}{a}\right) + \sec^{-1}\left(\frac{e^x}{a}\right) + c$
 (b) $\cosh^{-1}\left(\frac{e^x}{a}\right) - \sec^{-1}\left(\frac{e^x}{a}\right) + c$
 (c) $\frac{1}{a} \left[\cosh^{-1}\left(\frac{e^x}{a}\right) + \sec^{-1}\left(\frac{e^x}{a}\right) + c \right]$
 (d) $\frac{1}{a} \left[\cosh^{-1}\left(\frac{e^x}{a}\right) - \sec^{-1}\left(\frac{e^x}{a}\right) + c \right]$
131. $\int x\sqrt{1+x^2} dx =$
 (a) $\frac{1+2x^2}{\sqrt{1+x^2}} + c$ (b) $\sqrt{1+x^2} + c$
 (c) $3(1+x^2)^{3/2} + c$ (d) $\frac{1}{3}(1+x^2)^{3/2} + c$
132. The order of differential equation $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + \int y dx = x^3$ is
 (a) 2 (b) 3
 (c) 1 (d) 4
133. The differential equation of all straight lines passing through the origin is
 (a) $y = \sqrt{x} \frac{dy}{dx}$ (b) $\frac{dy}{dx} = y + x$
 (c) $\frac{dy}{dx} = \frac{y}{x}$ (d) None of these
134. The solution of the differential equation $3e^x \tan y dx + (1-e^x) \sec^2 y dy = 0$ is
 (a) $\tan y = c (1-e^x)^3$ (b) $(1-e^x)^3 \tan y = c$
 (c) $\tan y = c (1-e^x)$ (d) $(1-e^x) \tan y = c$
135. The solution of the differential equation $xy^2 dy - (x^3+y^3) dx = 0$ is
 (a) $y^3 = 3x^2 + c$
 (b) $y^3 = 3x^3 \log(cx)$
 (c) $y^3 = 3x^3 + \log(cx)$
 (d) $y^3 + 3x^3 = \log(cx)$
136. The solution of $y dx - x dy + 3x^2 y^2 e^{x^3} dx = 0$ is
 (a) $\frac{x}{y} + e^{x^3} = c$ (b) $\frac{x}{y} - e^{x^3} = c$
 (c) $\frac{-x}{y} + e^{x^3} = 0$ (d) None of these
137. The differential equation $\frac{dy}{dx} + \frac{y}{x} = y^2$ has a solution
 (a) $xy \cdot \log_e(cx) = 1$ (b) $xy \cdot \log_e x = c$
 (c) $xy \cdot \log_e(c/x) = 1$ (d) None of these
138. If the points $(-1, 2, -3)$, $(4, a, 1)$ and $(b, 8, 5)$ are collinear, then a and b are respectively equal to
 (a) 5 and 5 (b) 9 and 5
 (c) 5 and 9 (d) -5 and 9
139. The direction cosines of the line $4x - 4 = 1 - 3y = 2z - 1$ are
 (a) $\frac{3}{\sqrt{56}}, \frac{-4}{\sqrt{56}}, \frac{6}{\sqrt{56}}$ (b) $\frac{3}{\sqrt{29}}, \frac{-4}{\sqrt{29}}, \frac{6}{\sqrt{29}}$
 (c) $\frac{3}{\sqrt{61}}, \frac{-4}{\sqrt{61}}, \frac{6}{\sqrt{61}}$ (d) $\frac{4}{\sqrt{29}}, \frac{-3}{\sqrt{29}}, \frac{2}{\sqrt{29}}$
140. The point of intersection of lines $\frac{x-4}{5} = \frac{y-1}{2} = \frac{z}{1}$ and $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is
 (a) $(-1, -1, -1)$ (b) $(-1, -1, 1)$
 (c) $(1, -1, -1)$ (d) $(-1, 1, -1)$
141. The angle between two planes $2x - y + z = 6$ and $x + 2y + 3z = 3$ is
 (a) $\cos^{-1}\left(\frac{1}{2}\sqrt{1/7}\right)$ (b) $\cos^{-1}\left(\frac{1}{2}\sqrt{2/7}\right)$
 (c) $\cos^{-1}\left(\frac{1}{2}\sqrt{3/7}\right)$ (d) $\cos^{-1}\left(\frac{1}{2}\sqrt{4/7}\right)$

SPACE FOR ROUGH WORK

142. The line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ is parallel to the plane
 (a) $3x+4y+5z = 7$ (b) $2x + y - 2z = 0$
 (c) $x + y - z = 2$ (d) $2x + 3y + 4z = 0$
143. If the plane $2ax - 3ay + 4az + 6 = 0$ passes through the midpoint of the line joining the centres of the spheres $x^2 + y^2 + z^2 + 6x - 8y - 2z = 13$ and $x^2 + y^2 + z^2 - 10x + 4y - 2z = 8$, then a equals
 (a) -2 (b) 2
 (c) -1 (d) 1
144. If the straight lines $x = 1 + s, y = -3 - \lambda s, z = 1 + \lambda s$ and $x = t/2, y = 1+t, z = 2 - t$, with parameters s and π respectively, are co-planar, then λ equals
 (a) 0 (b) -1
 (c) $-1/2$ (d) -2
145. The shortest distance between L_1 and L_2 is
 (a) 0 (b) $\frac{17}{\sqrt{3}}$
 (c) $\frac{41}{5\sqrt{3}}$ (d) $\frac{17}{5\sqrt{3}}$
146. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = x\hat{i} + (x-2)\hat{j} - \hat{k}$. If the vector \vec{c} lies in the plane of \vec{a} and \vec{b} , then x equals
 (a) 0 (b) 1
 (c) -4 (d) -2
147. If $\vec{a} = (2, 1, -1), \vec{b} = (1, -1, 0), \vec{c} = (5, -1, 1)$, then unit vector parallel to $\vec{a} + \vec{b} - \vec{c}$ but in opposite direction is
 (a) $\frac{1}{2}(2\hat{i} - \hat{j} + 2\hat{k})$ (b) $-\frac{1}{3}(2\hat{i} - \hat{j} + 2\hat{k})$
 (c) $\frac{1}{3}(2\hat{i} + \hat{j} - 2\hat{k})$ (d) $-\frac{1}{2}(-2\hat{i} - \hat{j} + \hat{k})$
148. Three identical dice are rolled. The probability that same number will appear on each of them will be
 (a) $\frac{1}{6}$ (b) $\frac{1}{36}$
 (c) $\frac{1}{18}$ (d) $\frac{3}{28}$
149. The minimum value of the expression $\sin\alpha + \sin\beta + \sin\gamma$, where α, β, γ are real numbers satisfying $\alpha + \beta + \gamma = \pi$ is
 (a) positive (b) zero
 (c) negative (d) -3
150. The area of the equilateral triangle which contains three coins of unit radius is



- (a) $12 + 2\sqrt{3}$ sq. units
 (b) $6 + 4\sqrt{3}$ sq. units
 (c) $8 + \sqrt{3}$ sq. units
 (d) $4 + \frac{7\sqrt{3}}{2}$ sq. units