KCET EXAMINATION – 2021
SUBJECT : PHYSICS
VERSION : D1

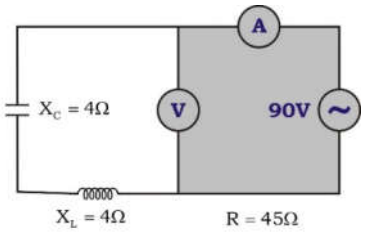
DATE :- 29-08-2021 **TIME : 10.30 AM TO 11.50 AM**

1. The physical quantity which is measure in the unit of wb A^{-1} is
   a) Self inductance b) Mutual inductance
   c) Magnetic flux d) Both A and B

Ans. **d**

Sol. $M = L = \frac{\phi}{I}$

2. What will be the reading in the voltmeter and ammeter of the circuit shown ?



   a) 90V, 2A b) 0V, 2A c) 90V, 1A d) 0V, 1A

Ans. **b**

Sol. $X_L = X_C$ circuit is in resonance

$V = V_L - V_C = 0$

$I = \frac{V}{R} = \frac{90}{45} = 2$

3. LC osillations are similar and analogous to the mechanical oscillations of a block attached to a spring. The electrical equivalent of the force constant of the spring is
   a) reciprocal of capacitive reactance
   b) capacitive reactance
   c) reciprocal of capacitance
   d) capacitance

Ans. **c**

Sol. $K = \frac{1}{LC} \Rightarrow K \propto \frac{1}{C}$

4. In an oscillating LC circuit, L=3.00mH and C=2.70μF. At t=0 the charge on the capacitor is zero and the current is 2.00A. The maximum charge that will appear on the capacitor will be
   a) $1.8\times10^{-5}C$ b) $18\times10^{-5}C$
   c) $9\times10^{-5}C$ d) $90\times10^{-5}C$

Ans. **b**

Sol. $\frac{1}{2}LI_0^2 = \frac{Q_0^2}{2C} \Rightarrow Q_0 = I_0\sqrt{LC}$

5. Suppose that the electric field amplitude of electromagnetic wave is $E_0 = 120NC^{-1}$ and its frequency if f=50 MHz. Then which of the following value is incorrectly computed ?
   a) Magnetic field amplitude is 400nT.
   b) Angular frequency of EM wave is $\pi\times10^8 rad/s$
   c) Propagation constant (angular wave number) is 2.1 rad/m
   d) Wavelength of EM wave is 6m.

Ans. **c**

Sol. Conceptual

6. The source of electromagnetic wave can be a charge.
   a) Moving with a constant velocity
   b) Moving in a circular orbit
   c) At rest
   d) Moving parallel to the magnetic field

Ans. **b**

Sol. Accelerated charges can produce electromagnetic waves

7. In refraction, light waves are bent on passing from one medium to second medium because, in the second medium.
a) frequency is different
b) speed is different
c) coefficient of elasticity is different
d) amplitude is smaller

Ans. **b**

Sol. Conceptual

8. If the refractive index from air to glass is $\frac{3}{2}$ and that from air to water is $\frac{4}{3}$, then the ratio of focal lengths of a glass lens in water and in air is
a) 1:2 b) 2:1 c) 1:4 d) 4:1

Ans. **d**

Sol. $\frac{f_w}{f_a} = \frac{(\mu_g - 1)}{\left(\frac{\mu_g}{\mu_w} - 1\right)}$

9. Two thin biconvex lenses have focal lengths f_1 and f_2. A third thin biconcave lens has focal length of f_3. If the two biconvex lenses are in contact, the total power of the lenses is P_1. If the first convex lens is in contact with the third lens, the total power is P_2. If the second lens is in contact with the third lens, the total power is P_3 then

a) $P_1 = \frac{f_1 f_2}{f_1 - f_2}, P_2 = \frac{f_1 f_3}{f_3 - f_1}$ and $P_3 = \frac{f_2 f_3}{f_3 - f_2}$

b) $P_1 = \frac{f_1 - f_2}{f_1 f_2}, P_2 = \frac{f_3 - f_1}{f_3 + f_1}$ and $P_3 = \frac{f_3 - f_2}{f_2 f_3}$

c) $P_1 = \frac{f_1 - f_2}{f_1 f_2}, P_2 = \frac{f_3 - f_1}{f_1 f_3}$ and $P_3 = \frac{f_3 - f_2}{f_2 f_3}$

d) $P_1 = \frac{f_1 + f_2}{f_1 f_2}, P_2 = \frac{f_3 - f_1}{f_1 f_3}$ and $P_3 = \frac{f_3 - f_2}{f_2 f_3}$

Ans. **d**

Sol. $p_1 = \frac{1}{f_1} + \frac{1}{f_2}, p_2 = \frac{1}{f_1} - \frac{1}{f_3}, p_3 = \frac{1}{f_2} - \frac{1}{f_3}$

10. The size of the image of an object, which is at infinity, as formed by a convex lens of focal length 30cm is 2cm. If a concave lens of focal length 20cm is placed between the convex lens and the image at a distance of 26cm from the lens, the new size of the image is :
a) 1.25 cm b) 2.5 cm c) 1.05 cm d) 2 cm

Ans. **b**

Sol. $V = f = 30\,\text{cm}, \frac{I}{O} = m = \frac{f}{f - u'}, u' = (30 - 26)\,\text{cm}$

11. A slit of width 'a' is illuminated by red light of wavelength $6500\,\text{Å}$. If the first diffraction minimum falls at 30°, then the value of 'a' is
a) 6.5×10^{-4} mm b) 1.3 micron
c) $3250\,\text{Å}$ d) 2.6×10^{-4} cm

Ans. **b**

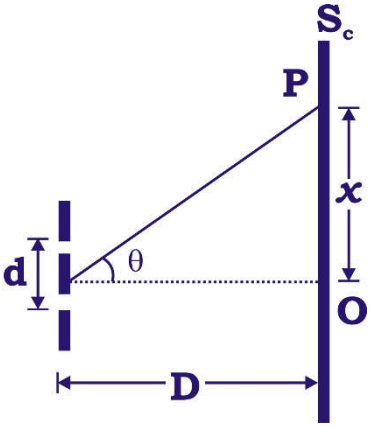
Sol. $n\lambda = a \sin\theta$

12. Which of the statements are correct with reference to single slit diffraction pattern?
(i) Fringes are of unequal width
(ii) Fringes are of equal width
(iii) Light energy is conserved
(iv) Intensities of all bright fringes are equal
a) (i) and (iii) b) (i) and (iv)
c) (ii) and (iv) d) (ii) and (iii)

Ans. **a**

Sol. Conceptual

13. In the Young's double slit experiment a monochromatic source of wavelength λ is used. The intensity of light passing through each slit is I_0. The intensity of light reaching the screen S_C at a point P, a distance X from O is given by (Take $d << D$)



a) $I_o \cos^2\left(\frac{\pi D}{\lambda d} x\right)$ b) $4I_o \cos^2\left(\frac{\pi d}{\lambda D} x\right)$
c) $I_o \sin^2\left(\frac{\pi d}{2\lambda D} x\right)$ d) $4I_o \cos\left(\frac{\pi d}{2\lambda D} x\right)$

Ans. **b**

Sol. $I_R = 4I_0 \cos^2\frac{\phi}{2}, \frac{\phi}{2} = \pi(\Delta x) = \pi d \frac{x}{D}$

14. The work function of a metal is 1eV. Light of wavelength $3000\,\text{Å}$ is incident on this metal surface. The velocity of emitted photoelectrons will be

a) $10 ms^{-1}$ b) $1\times10^{3}\,ms^{-1}$

c) $1\times10^{4}\,ms^{-1}$ d) $1\times10^{6}\,ms^{-1}$

Ans. d

Sol. $\frac{1}{2}mv^2 = E - W_0$

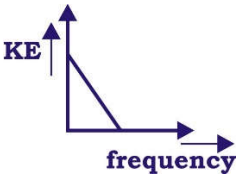
15. A proton moving with a momentum P_1 has a kinetic energy $\frac{1}{8}$th of its rest mass energy. Another light photon having energy equal to the kinetic energy of the possesses a momentum P_2. Then the ratio $\frac{P_1 - P_2}{P_1}$ is equal to

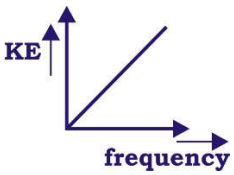
a) 1 b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{3}{4}$

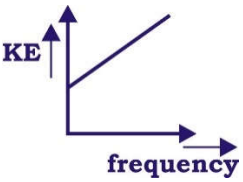
Ans. d

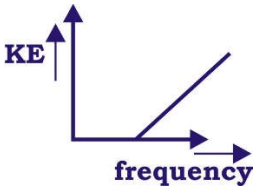
Sol. $\frac{p_1^{\,2}}{2m} = \frac{1}{8}mc^2,\ p_2 = mc$

16. According to Einstein's photoelectric equation to the graph between kinetic energy of photoelectrons ejected and the frequency of incident radiation is

a) 

b) 

c) 

d) 

Ans. d

Sol. Conceptual

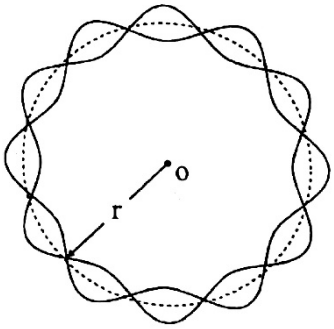
17. Energy of an electron in the second orbit of hydrogen atom is E_2. The energy of electron in the third orbit of He^+ will be

a) $\frac{9}{16}E_2$ b) $\frac{16}{9}E_2$ c) $\frac{3}{16}E_2$ d) $\frac{16}{3}E_2$

Ans. b

Sol. $E = -13.6\,eV\,\frac{Z^2}{n^2}$

18. The figure shows standing de Broglie waves due to the revolution of electron in a certain orbit of hydrogen atom. Then the expression for the orbit radius is (all notations have their usual meanings)



a) $\frac{h^2\,\epsilon_0}{\pi me^2}$ b) $\frac{4h^2\,\epsilon_0}{\pi me^2}$ c) $\frac{9h^2\,\epsilon_0}{\pi me^2}$ d) $\frac{16h^2\,\epsilon_0}{\pi me^2}$

Ans. NO OPTION

Sol. $n\lambda = 2\pi r_n$

$$mv_n r_n = \frac{6h}{2\pi}$$

$$\frac{me^2}{2nh\,\epsilon_0} r_n = \frac{3h}{\pi}$$

$$r_n = \frac{6nh^2\,\epsilon_0}{me^2\pi}$$

$$= \frac{36h^2\,\epsilon_0}{me^2\pi}$$

19. An electron in an excited state of Li^{2+} ion has angular momentum $\frac{3h}{2\pi}$. The de Broglie wavelength of electron in this state is $P\pi a_0$ (where $a_0 = $ Bohr radius). The value of P is

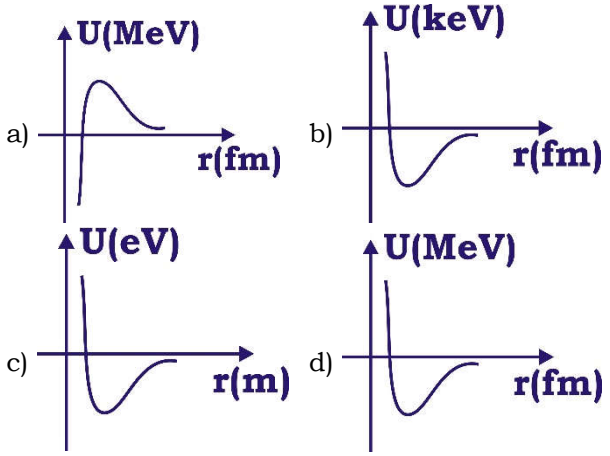
a) 3 b) 2 c) 1 d) 4

Ans. b

Sol. $\lambda = \frac{h}{p} = \frac{hr}{mvr} = \frac{hr}{\left(\frac{3h}{2\pi}\right)}$

$$r = a_0\left(\frac{n^2}{z}\right)$$

20. Which graph in the following diagram correctly represents the potential energy of a pair of nucleons as a function of their separation?



Ans. **d**

Sol. Conceptual

21. In a nuclear reactor heavy nuclei is not used as moderators because

a) They will break up

b) Elastic collision of neutrons with heavy nuclei will not slow them down

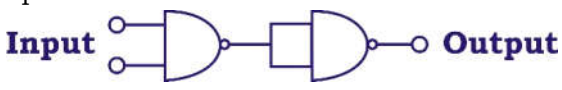
c) The net weight of the reactor would be unbearably high

d) Substance with heavy nuclei do not occur in liquid or gaseous state at room temperature

Ans. **b**

Sol. Conceptual

22. The circuit given represents which of the logic operations?



a) OR b) AND c) NOT d) NOR

Ans. **b**

Sol. Conceptual

23. Identify the incorrect statement:

a) when a P-N junction diode is forward biased, the width of the depletion region decreases.

b) when a P-N junction diode is reverse biased, the barrier potential increases

c) a photon diode is operated in the reverse bias

d) an LED is a lightly doped P-N junction diode which emits spontaneous radiation of forward biasing.

Ans. **d**

Sol. LED is heavily doped operates in forward bias.

24. Three phtodiodes D_1, D_2 and D_3 are made of semiconductors having band gaps of 2.5eV, 2eV and 3eV respectively. Which one will be able to detect light of wavelength 600 nm?

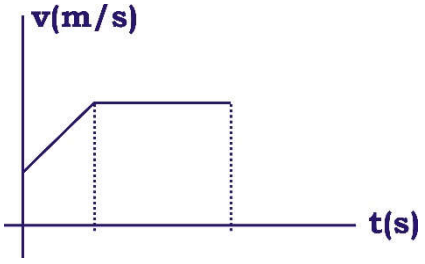
a) D_1 only b) both D_1 and D_3

c) D_2 only d) All the three diodes

Ans. **a**

Sol. Conceptual

25. For a body moving along a straight line, the following v-t graph is obtained.



According to the graph, the displacement during

a) Uniform acceleration is greater than that during uniform motion

b) Uniform acceleration is less than that during uniform motion

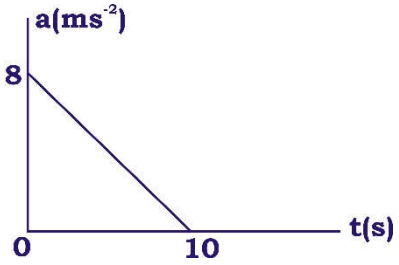
c) Uniform acceleration is equal to that during uniform motion

d) Uniform motion zero

Ans. **b**

Sol. Conceptual

26. A particle starts from rest. Its acceleration 'a' versus time 't' is shown in the figure. The maximum speed of the particle will be:



a) 80 ms^{-1} b) 40 ms^{-1} c) 18 ms^{-1} d) 2 ms^{-1}

Ans. **b**

Sol. V_{max} = area of a – t graph

$$V_{max} = \frac{1}{2}(10)(8) = 40\,m/s$$

27. The maximum range of a gun on horizontal plane is 16 km. If $g = 10\,ms^{-2}$, then muzzle velocity of a shell is

a) $160\,ms^{-1}$ b) $200\sqrt{2}\,ms^{-1}$

c) $400\ ms^{-1}$ d) $800\ ms^{-1}$

Ans. c

Sol. $\frac{u^2}{g} = 16(10)^3 \Rightarrow u = \sqrt{16\times10^3\times g} = 400\,m/s$

28. The trajectory of projectile is

a) Semicircle

b) An ellipse

c) A parabola always

d) A parabola in the absence of air resistance

Ans. d

Sol. Conceptual

29. For a projectile motion, the angle between the velocity and acceleration is minimum and acute at

a) Only one point b) Two points

c) Three points d) Four points

Ans. a

Sol. Conceptual

30. A particle starts from the origin at t=0s with a velocity of $10\,\hat{j}\ ms^{-1}$ and move in the x-y plane with a constant acceleration of $\left(8\,\hat{j}+2\hat{j}\right)ms^{-2}$.

At an instant when the x-coordinate of the particle is 16 m, y-coordinate of the particle is:

a) 16m b) 28m c) 36m d) 24m

Ans. d

Sol. $x = u_x t + \frac{1}{2}a_x t^2 \Rightarrow 16 = 0 + \frac{1}{2}(8)t^2 \Rightarrow t = 2s$

$\therefore y = u_y t + \frac{1}{2}a_y t^2 \Rightarrow y = 10(2) + \frac{1}{2}(2)(2)^2 = 24\,m$

31. A coin placed on a rotating turn table just slips if it is placed at a distance of 4cm from the centre. If the angular velocity of the turn table is doubled it will just slip at a distance of

a) 1cm b) 2cm c) 4cm d) 8cm

Ans. a

Sol. $mr\omega^2 = \mu mg \Rightarrow r \propto \frac{1}{\omega^2} \Rightarrow r_2 = r_1\left(\frac{\omega_1}{\omega_2}\right)^2$

32. A 1kg ball moving at $12ms^{-1}$ collides with a 2kg ball moving in opposite direction at $24\,ms^{-1}$. If the coefficient of restitution is $\frac{2}{3}$, the their velocities after the collision are

a) $-4\,ms^{-1}, -28\,ms^{-1}$ b) $-28\,ms^{-1}, -4\,ms^{-1}$

c) $4\,ms^{-1}, 28\,ms^{-1}$ d) $28\,ms^{-1}, 4\,ms^{-1}$

Ans. b

Sol. $V_1 = \frac{(m_1 - em_2)u_1 + m_2(1+e)u_2}{m_1 + m_2}$

$V_2 = \frac{m_1(1+e)u_1 + (m_2 - em_1)u_2}{m_1 + m_2}$

$u_1 = 12m/s,\ u_2 = -24m/s,\ m_1 = 1kg,\ m_2 = 2kg$

33. A ball hits the floor and rebounds after an inelastic collision. In this case

a) The momentum of the ball is conserved

b) The mechanical energy of the ball is conserved

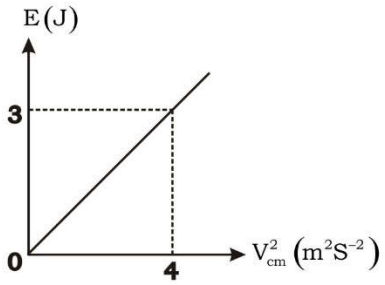
c) The total momentum of the ball and the earth is conserved

d) The total mechanical energy of the ball and the earth is conserved

Ans. c

Sol. Conceptual

34. In figure E and V_{cm} represent the total energy and speed of centre of mass of an object of mass 1kg in pure rolling. The object is:



a) Sphere b) Ring

c) Disc d) Hollow Cylinder

Ans. c

Sol. $\frac{1}{2}mv^2(1+\beta) = E$

$\frac{1}{2}m(1+\beta) = \frac{3}{2}$

$1+\beta = \frac{3}{2}$

$\beta = \frac{1}{2}$

35. Two bodies of masses 8kg are placed at the vertices A and B of an equilateral triangle ABC. A third body of mas 2kg is placed at the centroid G of the triangle. If AG=BG=CG=1m, where should a fourth body of mass 4kg be placed so that the resultant force on the 2kg body is zero?

a) At C

b) At a point P on the line CG such that $PG = \frac{1}{\sqrt{2}}m$

c) At a point P on the line CG such that PG=0.5 m

d) At a point P on the line CG such that PG=2m

Ans. b

Sol. $F = \frac{Gm_1m_2}{r^2}$

$F_1 = \frac{G(16)}{1}$

$F_2 = G(16)$

$F' = \sqrt{F_1^2 + F_2^2 + 2F_1F_2}\cos\theta$

= 16h

$F' + F'' = 0$

$16G + \frac{8G}{r^2} = 0$

$\frac{8G}{r^2} = -16G$

$r^2 = \frac{1}{2} \Rightarrow r = \frac{1}{\sqrt{2}}$

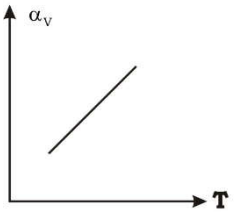
36. Two capillary tubes P and Q are dipped vertically in water. The height of water level in capillary tube P is $\frac{2^{rd}}{3}$ of the height in capillary tube Q. The ratio of their diameter is ____

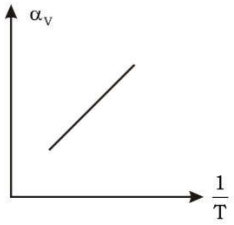
a) 2:3 b) 3:2 c) 3:4 d) 4:3

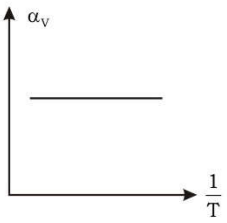
Ans. b

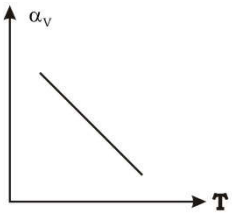
Sol. $h \propto \frac{1}{r}$

37. Which of the following curves represent the variation of coefficient of volume expansion of an ideal gas at constant pressure?

a) 

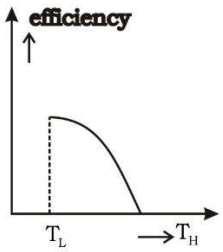
b) 

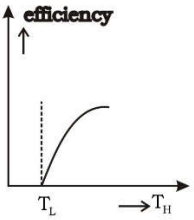
c) 

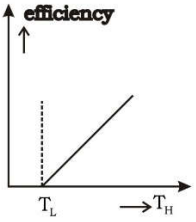
d) 

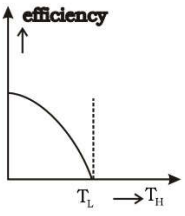
Ans. c

38. A number of cannot engines are operated at identical cold reservoir temperatures (T_L). However, their hot reservoir temperatures are kept different. A graph of the efficiency of the engines versus hot reservoir temperature (T_H) is plotted. The correct graphical representation is

a) 

b) 

c) 

d) 

Ans. b

Sol. Conceptual

39. A gas mixture contains monoatomic and diatomic molecules of 2 moles each. The mixture has a total internal energy of (symbols have usual meanings)

a) 3RT b) 5RT c) 8RT d) 9RT

Ans. c

Sol. $du = \frac{f}{2}nRT$

40. A pendulum oscillates simple harmonically and only if
i. The sizer of the bob of pendulum is negligible in comparison with the length of the pendulum
ii. The angular amplitude is less than 10^{o}
a) Both i and ii are correct
b) Both i and ii are incorrect
c) Only i is correct
d) Only ii is correct

Ans. **a**

Sol. Conceptual

41. To propagate both longitudinal and transverse waves, a material must have
a) Bulk and shear moduli
b) Only bulk modulus
c) Only shear modulus
d) Young's and Bulk modulus

Ans. **d**

Sol. Conceptual

42. A copper rod AB of length l is rotated about end A with a constant angular velocity ω. The electric field at a distance x from the axis of rotation is

a) $\frac{m\omega^2 x}{e}$ b) $\frac{m\omega x}{el}$ c) $\frac{mx}{\omega^2 l}$ d) $\frac{me}{\omega^2 x}$

Ans. **a**

Sol. $F = ma$

$qE = m\omega^2 x$

43. Electric field due to infinite, straight uniformly charged wire varies with distance 'r' as

a) r b) $\frac{1}{r}$ c) $\frac{1}{r^2}$ d) r^2

Ans. **b**

Sol. $E = \frac{\lambda}{2\pi\varepsilon_0 r}$

44. A 2 – gram object, located in a region of uniform electric field $\vec{E} = (300\,N\,C^{-1})\hat{i}$ carries a charge Q. The object released from rest at $x = 0$, has a kinetic energy of 0.12 J at x = 0.5 m. Then Q is

a) $400\,\mu c$ b) $-400\,\mu c$ c) $800\,\mu c$ d) $-800\,\mu c$

Ans. **c**

Sol. $EqX = \frac{1}{2}mv^2$

45. If a slab of insulating material (conceptual). 4×10^{-3}m thick is introduced between the plates of a parallel plate capacitor, the separation between the plates has to be increased by 3.5×10^{-3}m to restore the capacity to original value. The dielectric constant of the material will be

a) 6 b) 8 c) 10 d) 12

Ans. **b**

Sol. $x = t\left(1-\frac{1}{k}\right)$

46. Eight drops of mercury of equal radii combine to form a big drop. The capacitance of a bigger drop as compared to each smaller drop is

a) 2 times b) 8 times c) 4 times d) 16 times

Ans. **a**

Sol. $C' = n^{\frac{1}{3}}c$

47. Which of the statements is false in the case of polar molecules?
a) Centers of positive and negative charges are separated in the absence of external electric field.
b) Centers of positive and negative charges are separated in the presence of external electric field.
c) Do not possess permanent dipole moments
d) Ionic molecule HCl is the example of polar molecule.

Ans. **c**

Sol. Conceptual

48. An electrician requires a capacitance of 6 μF in a circuit across a potential difference of 1.5 kV. A large number of 2 μF capacitors which can withstand a potential difference of not more than 500 V are available. The minimum number of capacitors required for the purpose is

a) 3 b) 9 c) 6 d) 27

Ans. **d**

Sol. No. of capacitors in a row,

$n = \frac{\text{desired voltage}}{\text{voltage across each capacitor}}$

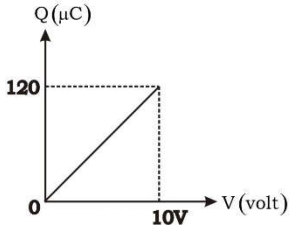
$n = \frac{1500}{500} = 3$

No. of rows, $m = \frac{\text{desired capacitance}}{\text{Total capacitance in each row}}$

$m = \frac{6}{\left(\frac{2}{3}\right)} = 9$

Total no. of capacitors = $n\times m = 3\times 9 = 27$

49. In figure, charge on the capacitor is plotted against potential difference across the capacitor. The capacitance and energy stored in the capacitor are respectively.



a) 12 μF, 1200 μJ b) 12 μF, 600 μJ
c) 24 μF, 600 μJ d) 24 μF, 1200 μJ

Ans. b

Sol. $C = \frac{Q}{V}$

$U = \frac{1}{2}QV$

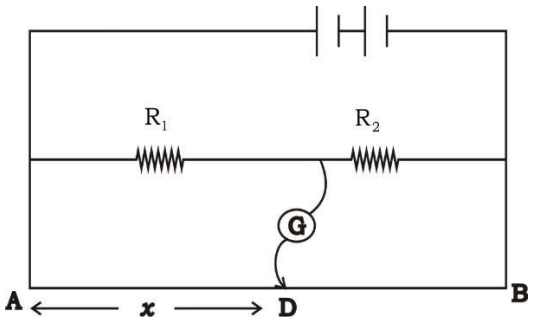
50. A wire of resistance 3Ω is stretched to twice its original length. The resistance of the new wire will be

a) 1.5Ω b) 3Ω c) 6Ω d) 12Ω

Ans. d

Sol. $R \propto \ell^2$

51. In the given arrangement of experiment on metre bridge, if AD corresponding to null deflection of the galvanometer is X, what would be its value if the radius of the wire AB is doubled?



a) X b) $\frac{X}{4}$ c) 4 X d) 2 X

Ans. c

Sol. $R = \frac{\rho l}{\pi r^2}$

52. A copper wire of length 1 m and uniform cross sectional area $5\times10^{-7}\,m^2$ carries a current of 1 A. Assuming that there are 8×10^{28} free electrons per m^3 in copper, how long will an electron take to drift from one end of the wire to the other?

a) $0.8\times10^3\,S$ b) $1.6\times10^3\,S$
c) $3.2\times10^3\,S$ d) $6.4\times10^3\,S$

Ans. d

Sol. $\text{time } T = \frac{L}{V_d}$, $I = neAV_d$

53. Consider an electrical conductor connected across a potential difference V. Let Δq be a small charge moving through it in time Δt. If I is the electric current through it,
(i) the kinetic energy of the charge increases by $IV\Delta t$.
(ii) the electric potential energy of the charge decreases by $IV\Delta t$.
(iii) the thermal energy of the conductor increases by $IV\Delta t$.
Then the correct statements is/are

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

Ans. b

Sol. If charges mode without collisions through the conductor, kinetic energy would also change so that the total energy is unchanged.
Then $\Delta K = -\Delta U = IV\Delta t$

54. A strong magnetic field is applied on a stationary electron. Then the electron
a) Moves in the direction of the field
b) Moves in an opposite direction of the field
c) Remains stationary
d) Starts spinning

Ans. c

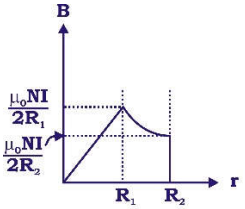
Sol. Conceptual

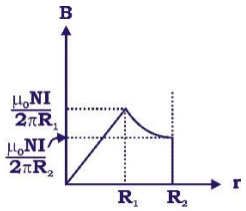
55. Two parallel wires in free space are 10 cm apart and each carries a current of 10 A in the same direction. The force exerted by one wire on the other [per unit length] is
a) $2\times10^{-4}\ Nm^{-1}$[attractive]
b) $2\times10^{-7}\ Nm^{-1}$[attractive]
c) $2\times10^{-4}\ Nm^{-1}$[repulsive]
d) $2\times10^{-7}\ Nm^{-1}$[repulsive]

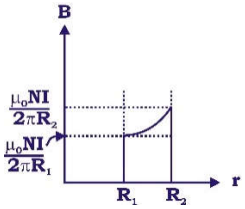
Ans. a

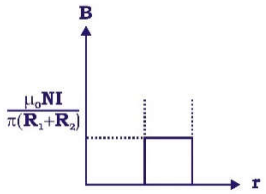
Sol. $\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi r}$

56. A toroid with thick windings of N turns has inner and outer radii R_1 and R_2 respectively. If it carries certain steady current I, the variation of the magnetic field due to the toroid with radial distance is correctly graphed in

a) 

b) 

c) 

d) 

Ans. d

Sol. for $r < R_1$, $B = 0$

for $R_1 < r < R_2$, $B = \text{Constant}$

57. A tightly wound long solenoid has 'n' turns per unit length, a radius 'r' and carries a current I. A particle having charge 'q' and mass 'm' is projected from a point on the axis in a direction perpendicular to the axis. The maximum speed of the particle for which the particle does not strike the solenoid is

a) $\frac{\mu_0 nIqr}{m}$ b) $\frac{\mu_0 nIqr}{2m}$

c) $\frac{\mu_0 nIqr}{4m}$ d) $\frac{\mu_0 nIqr}{8m}$

Ans. b

Sol. $V = \frac{BqR}{2m}$

58. Earth's magnetic field always has a horizontal component except at

a) equator

b) magnetic poles

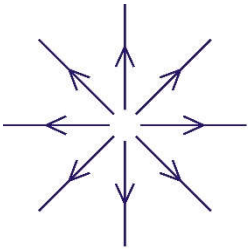
c) a latitude of 60°

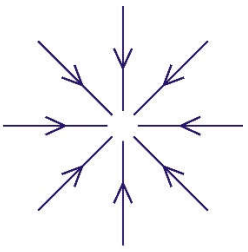
d) an altitude of 60°

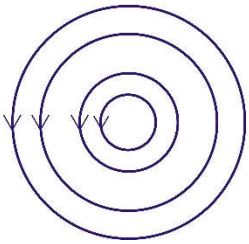
Ans. b

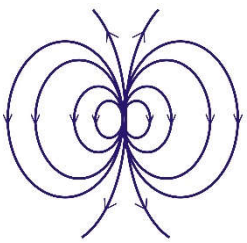
Sol. Conceptual

59. Which of the field pattern given below is valid for electric field as well as for magnetic field?

a) 

b) 

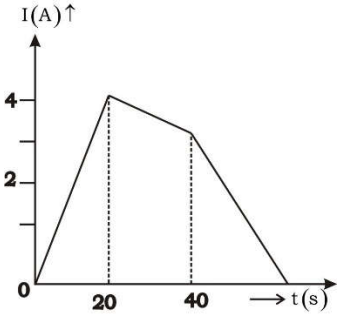
c) 

d) 

Ans. c

Sol. Time varying magnetic field causes time varying electric field.

60. The current following through an inductance coil of self inductance 6 mH at different time instants is as shown. The emf induced between $t = 20\,s$ and $t = 40\,s$ is nearly



a) $2\times10^{-2}\,V$ b) $3\times10^{-2}\,V$

c) $4\times10^{-3}\,V$ d) $30\times10^{2}\,V$

Ans. NO OPTION

Sol. $e = L\frac{dI}{dt}$

$= 3\times10^{-4}$

No option.

KCET EXAMINATION – 2021
SUBJECT : CHEMISTRY

VERSION : C3

DATE :- 29-08-2021 **TIME : 10.30 AM TO 11.50 AM**

1. For the reaction

$A(g)+B(g) \rightleftharpoons C(g)+D(g);\ \Delta H=-QKJ$

The equilibrium constant cannot be disturbed by

a) Addition of A
b) Addition of D
c) Increasing of pressure
d) Increasing of temperature

Ans. c

Sol. $A_{(g)}+B_{(g)} \rightleftharpoons C_{(g)}+D_{(g)};\Delta H=-Q\ KJ$

Pressure has no effect on equilibrium state if $\Delta n=0$

2. An organic compound 'X' on treatment with PCC in dichloromethane gives the compound Y. Compound 'Y' reacts with I_2 and alkali to form yellow precipitate of triiodomethane. The compound X is

a) CH_3CHO b) CH_3COCH_3
c) CH_3CH_2OH d) CH_3COOH

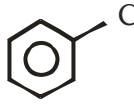
Ans. c

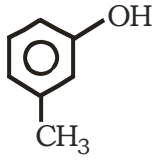
Sol.

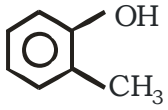
$$CH_3-\overset{X}{C}H_2-OH \xrightarrow[CH_2Cl_2]{PCC} CH_3-\overset{Y}{C}HO \xrightarrow[NaOH]{I_2} CHI_3+HCOONa$$

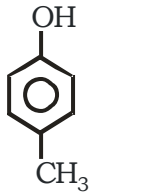
$\therefore X=CH_3CH_2OH$

3. A compound 'A' (C_7H_8O) is insoluble in $NaHCO_3$ solution but dissolve in NaOH and give a characteristic colour with neutral $FeCl_3$ solution. When treated with Bromine water compound 'A' forms the compound B with the formula $C_7H_5OBr_3$. 'A' is

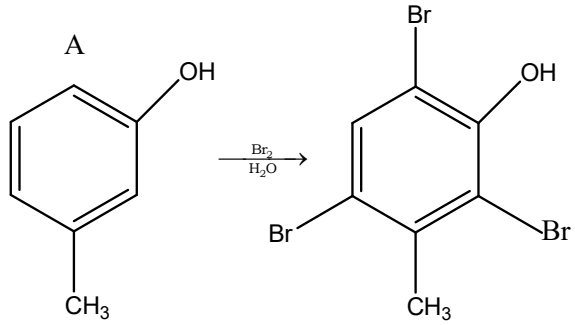
a) 

b) 

c) 

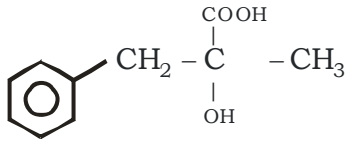
d) 

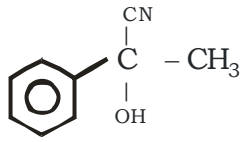
Ans. b

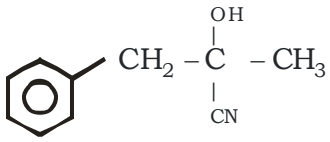
Sol. 

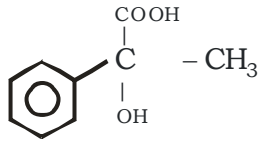
4. In set of reactions, identify D

$$CH_3COOH \xrightarrow{SOCl_2} A \xrightarrow[\text{Anh } AlCl_3]{\text{Benzene}} B \xrightarrow{HCN} C \xrightarrow{H_2O} D$$

a) 

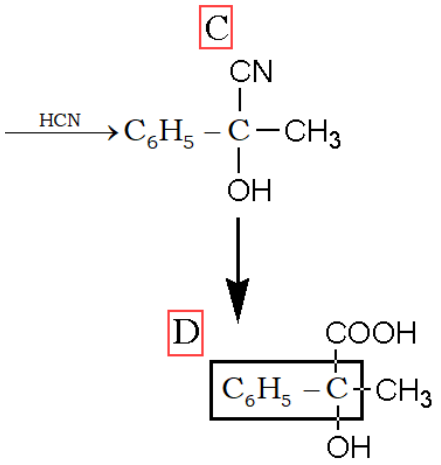
b) 

c) 

d) 

Ans. d

Sol. $CH_3-COOH \xrightarrow{SoCl_2} \overset{A}{CH_3COCl} \xrightarrow[\text{anhydrous } AlCl_3]{C_6H_6} \overset{B}{C_6H_5COCH_3}$



5. K_a values for acids H_2SO_3, HNO_2, CH_3COOH and HCN are respectively 1.3×10^{-2}, 4×10^{-4}, 1.8×10^{-5} and 4×10^{-10}, which of the above acids produces stronger conjugate base in aqueous solution ?

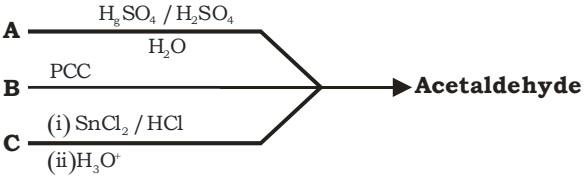
a) H_2SO_3 b) HNO_2

c) CH_3COOH d) HCN

Ans. d

Sol. Acidic strength $\propto$ Ka

The conjugate base of a weakest acid is strongest $\therefore$ HCN $\left(K_a = 4\times10^{-10}\right)$(least value)

6. 

A, B and C respectively are

a) ethanol, ethane nitrile and ethyne

b) ethane nitrile, ethanol and ethyne

c) ethyne, ethanol and ethane nitrile

d) ethyne, ethane nitrile and ethanol

Ans. c

Sol. $A \rightarrow CH\equiv CH \xrightarrow[H_2SO_4]{HgSO_4} CH_2=CH-OH \xrightleftharpoons{\text{Tautamerises}} CH_3CHO$

$B \rightarrow CH_3CH_2OH \xrightarrow{PCC} CH_3CHO$

$C \rightarrow CH_3CN \xrightarrow[(ii)H_3O^+]{(i)SnCl_2/HCl} CH_3CHO$

7. The reagent which can do the conversion $CH_3COOH \rightarrow CH_3-CH_2-OH$ is

a) $LiAlH_4$ / ether b) H_2, Pt

c) $NaBH_4$ d) Na and C_2H_5OH

Ans. a

Sol. $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH$

8. $CH_3CHO \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3MgBr} A \xrightarrow[\Delta]{\text{Conc } H_2SO_4} B \xrightarrow[(ii)\ H_2O,\ OH^-]{(i)\ B_2H_6} C$

A and C are

a) Identical b) Position isomers

c) Functional d) Optical isomers

Ans. b

Sol. $CH_3CHO \xrightarrow[(ii)H_3O^+]{(i)CH_3MgBr} \underset{A}{CH_3-\overset{CH_3}{\overset{|}{C}}H-OH} \xrightarrow[\Delta]{conc.H_2SO_4}$

$CH_3-CH=CH_2 \xrightarrow[(ii)H_2O,OH^-]{(i)B_2H_6} CH_3CH_2CH_2OH$

B C

$\therefore$ A and C are position isomers.

9. Which of the following is not true for oxidation?

a) addition of oxygen

b) addition of electronegative element

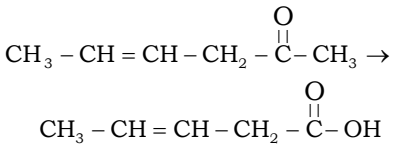
c) removal of hydrogen

d) removal of electronegative element

Ans. d

Sol. Conceptual

10. Which is the most suitable reagent for the following conversion ?



a) Tollen's reagent
b) Benzoyl peroxide
c) I_2 and NaOH solution with subsequent acidification
d) Sn and NaOH solution

Ans. **c**

Sol. Conceptual

11. $C_6H_5CH_2Cl \xrightarrow{alc.NH_3} A \xrightarrow{2CH_3Cl} B$. The product B is
a) N, N-Dimethyl phenyl methanamine
b) N, N-Dimethyl benzenamine
c) N-Benzyl-N-methyl methanamine
d) phynyl-N-N-dimethyl methanamine

Ans. **a**

Sol. $C_6H_5CH_2Cl \xrightarrow{alc.NH_3} \overset{A}{C_6H_5CH_2NH_2} \xrightarrow{2CH_3Cl} \overset{B}{C_6H_5CH_2N(CH_3)_2}$

12. The method by which aniline cannot be prepared is
a) Nitration of benzene followed by reduction with Sn and con. HCl
b) Degradation of benzamide with bromine in alkaline solution
c) Reduction of nitrobenzene with H_2/Pd is ethanol
d) Potassium salt of pthalimide treated with chlorobenzene followed by the hydrolysis with aqueous NaOH solution

Ans. **d**

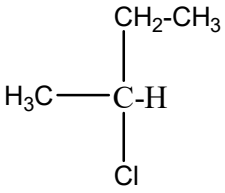
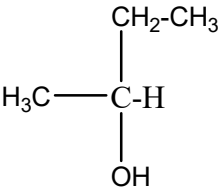
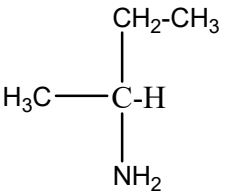
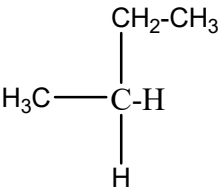
Sol. Conceptual

13. Permanent hardness cannot be removed by
a) Using washing soda
b) Calgon's method
c) Clark's method
d) Ion exchange method

Ans. **c**

Sol. Conceptual

14. A hydrocarbon $A(C_4H_8)$ on reaction with HCl gives a compound $B(C_4H_9Cl)$ which on reaction with 1 mol of NH_3 gives compound $C(C_4H_{10}N)$. On reacting with $NaNO_2$ and HCl followed by treatment with water, compound C yields an optically active compound D. The is

a) 
b) 
c) 
d) 

Ans. **b**

Sol. Optically active compound is option B.

15. RNA and DNA are chiral molecules, their chirality is due to the presence of
a) D-sugar component
b) L-sugar component
c) Chiral bases
d) Chiral phosphate ester unit

Ans. **a**

Sol. Conceptual

16. The property of the alkaline earth metals that increases with their atomic number is
a) Ionisation enthalpy
b) Electronegativity
c) Solubility of their hydroxide in water
d) Solubility of their sulphate in water

Ans. **c**

Sol. Conceptual

17. Primary structure in a nucleic acid contains bases as GATGC ... The chain which is complementary to this chain is
a) G G T G A ....
b) T G A A G ....
c) C T A C G ...
d) T T T A G ....

Ans. **c**

Sol. Conceptual

18. In the detection of II group acid radical, the salt containing chloride is treated with concentrated sulphuric acid, the colourless gas is liberated. The name of the gas is
a) Hydrogen chloride gas
b) Chlorine gas
c) Sulphur dioxide gas
d) Hydrogen gas

Ans. **a**

Sol. Conceptual

19. The number of six membered and five membered rings in Buckminster Fullerence respectively is
a) 20, 12 b) 12, 20 c) 14, 18 d) 14, 11

Ans. **a**

Sol. Conceptual

20. In chrysoberyl, a compound containing Beryllium, Aluminium and oxygen, oxide ions form cubic close packed structure. Aluminium ions occupy $\frac{1}{4}$th of octahedral voids. The formula of the compound is
a) $BeAlO_4$ b) $BeAl_2O_4$ c) Be_2AlO_2 d) $BeAlO_2$

Ans. **b**

Sol. Be Al O N = No.of oxide ions invoved in CCP

$\frac{N}{4} : \frac{2N}{4} : N \therefore$ octahedral voids $= N$

1 : 2 : 4 Tetrahedral voids $= 2N$

21. The correct statement regarding defects in solid is
a) Frenkel defect is a vacancy defect
b) Schottky defect is a dislocation defect
c) Trapping of an electron in the lattice leads to the formation of F-centre
d) Schottky defect has no effect on density

Ans. **c**

Sol. Frenkel defect – dislocation defect
Schottky defect – decreases density
F-centre – Trapping of on electrons in the lattices

22. A metal crystallises in BCC lattice with unit cell edge length of 300 pm and density $6.15 gcm^{-3}$. The molar mass of the metal is
a) $50 g mol^{-1}$ b) $60 g mol^{-1}$
c) $40 g mol^{-1}$ d) $70 g mol^{-1}$

Ans. **a**

Sol. $d = \frac{ZM}{a^3 N_A}$

$$M = \frac{d a^3 N_A}{Z} = \frac{6.15 \times \left(300 \times 10^{-10}\right)^3 \times 6 \times 10^{23}}{2}$$
$$\cong 50 g\ mol^{-1}$$

23. 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 at 298K 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}

Ans. **a**

Sol. $P_{N_2} = X_{N_2} . P_{total}$

$= 0.8 \times 5 = 4$ atm

$P_{N_2} = K_H . X_{N_2}$

$4 = 10^5 . X_{N_2}$

$X_{N_2} = 4 \times 10^{-5}$

$$X_{N_2} = \frac{n_{N_2}}{n_{N_2} + n_{H_2O}} \quad \left(n_{N_2} <<<<< n_{H_2O}\right)$$

$$4 \times 10^{-5} = \frac{n_{N_2}}{10}$$

$n_{N_2} = 4 \times 10^{-4}$

24. A pure compound contains 2.4g of C, 1.2×10^{23} atoms of H, 0.2 moles of oxygen atoms. Its empirical formula is
a) C_2HO b) $C_2H_2O_2$ c) CH_2O d) CHO

Ans. **d**

Sol. $2.4g\ C = \frac{2.4}{12} = 0.2 mol$

1.2×10^{23} atoms of $H = \frac{1.2 \times 10^{23}}{6 \times 10^{23}} = 0.2$ mol

0.2 mole of 'O' atoms

$\therefore$ simplest ratio = C : H : O

0.2 : 0.2 : 0.2

= CHO

25. Choose the correct statement

a) K_H value is same for a gas in any solution

b) Higher the K_H value more the solubility of gas

c) K_H value increases on increasing the temperature of the solution

d) Easily liquefiable gases usually has lesser K_H values

Ans. c

Sol. K_H value changes with solvent nature

Higher the K_H less is solubility

K_H value increase with increase of 'T'

Eerily liquefied gases have high K_H value

26. The K_H value (K bar) of Argon (I), Carbondioxide (II) formuldehyde (III) and methane (IV) are respectively 40.3, 167, 1.83×10^{-5} and 0.413 at 298 K. The increasing order of solubility of gas in liquid is

a) I < II < IV < III b) III < IV < II < I

c) I < III < II < IV d) I < IV < II < III

Ans. a

Sol. $P_H = K_H \times$

$$K_H \propto \frac{1}{X(\text{solubility})}$$

$\therefore$ more is the K_H less is the solubility

27. The vapour pressure of pure liquids A and B are 450 and 700 mm of Hg at 350 K respectively. If the total vapour pressure of the mixture is 600 mm of Hg, the composition of the mixture in the solution is

a) $x_A = 0.4, x_B = 0.6$ b) $x_A = 0.6, x_B = 0.4$

c) $x_A = 0.3, x_B = 0.7$ d) $x_A = 0.7, x_B = 0.3$

Ans. a

Sol. $P_{total} = P_A^O X_A + P_B^O X_B$

$$= P_A^O X_A + P_B^O (1 - X_A)$$

$$600 = 450.X_A + 700(1 - X_A)$$

$$X_A = 0.4$$

$$X_B = 1 - 0.4 = 0.6$$

28. Consider the following electrodes

$P = Zn^{2+}(0.0001M)/Zn$ $Q = Zn^{2+}(0.1M)/Zn$

$R = Zn^{2+}(0.01M)/Zn$ $S = Zn^{2+}(0.001M)/Zn$

$E^oZn/Zn^{2+} = -0.76V$ electrode potentials of the above electrodes in volts are in the order

a) P > S > R > Q b) S > R > Q > P

c) Q > R > S > P d) P > Q > R > S

Ans. c

Sol. $Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$

$$E_{red} = E^{\Theta}_{red} - \frac{0.059}{n}\log\frac{1}{[Zn^{2+}]}$$

$$E_{red} = -0.76 + \frac{0.059}{2}\log[Zn^{2+}]$$

$$\text{as } [Zn^{2+}] \uparrow E_{red} \uparrow$$

29. The number of angular and radial nodes in 3p orbital respectively are

a) 3,1 b) 1,1 c) 2,1 d) 2,3

Ans. b

Sol. No. of angular nodes = l = 1 (3p)

No. of radial nodes = n – l - 1 = 3-1-1=1

30. The resistance of 0.01 m KCl solution at 298 K is 1500 Ω. If the conductivity of 0.01 m KCl solution at 298 K is 0.1466×10^{-3} S cm^{-1}. The cell constant of the conductivity cell in cm^{-1} is

a) 0.219 b) 0.291 c) 0.301 d) 0.194

Ans. a

Sol. $G^* = KR$

$$= 0.146\times10^{-3}\times1500$$

$$= 0.219$$

31. $H_{2(g)} + 2AgCl_{(s)} \rightleftarrows 2Ag_{(s)} + 2HCl_{(aq)}$

E^o_{cell} at 25°C for the cell is 0.22 V. The equilibrium constant at 25°C is

a) 2.8×10^7 b) 5.2×10^8

c) 2.8×10^5 d) 5.2×10^4

Ans. a

Sol. $$\log K_c = \frac{E^{\Theta}_{cell}\times n}{} = \frac{0.22\times2}{} = 7.45$$

$$K_c = \text{Antilog}(7.45) = 2.8\times10^7$$

32. For a reaction $A + 2B \rightarrow Products$, when concentration of B alone is increased half life remains the same. If concentration of A alone is doubled, rate remains the same. The unit of rate constant for the reaction is

a) S^{-1} b) $L\ mol^{-1}\ S^{-1}$

c) $mol\ L^{-1} S^{-1}$ d) atm^{-1}

Ans. **a**

Sol. As $['B']$ increase, $t_{\frac{1}{2}}$ remains same

i.e. 1st order with respect to 'B'

$rate = k[A]^0[B]^1$

overall order = 1

$\therefore$ units of $k = S^{-1}$

33. The third ionisation enthalpy is highest in

a) Alkali metals

b) Alkaline earth metals

c) Chalcogens

d) Pnictogens

Ans. **b**

Sol. Conceptual

34. If the rate constant for a first order reaction is k, the time(t) required for the completion of 99% of the reaction is given by

a) $t = \frac{4.606}{k}$ b) $t = \frac{2.303}{k}$

c) $t = \frac{0.693}{k}$ d) $t = \frac{6.909}{k}$

Ans. **a**

Sol. $t = \frac{2.303}{k}\log\frac{[R]_0}{[R]}$

$= \frac{2.303}{k}\log\left(\frac{100}{1}\right)$

$= \frac{4.606}{k}$

35. The rate of a gaseous reaction is given by the expression $k[A][B]^2$. If the volume of vessel is reduced to one half of the initial volume, the reaction rate as compared to original rate is

a) $\frac{1}{16}$ b) $\frac{1}{8}$ c) 8 d) 16

Ans. **c**

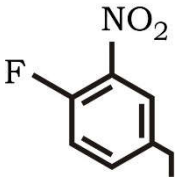
Sol. $rate = K[A]^1[B]^2$

$= K\left[\frac{n}{v}\right]_A^1\left[\frac{n}{v}\right]_B^2$

$= K\left[\frac{\frac{n}{v}}{2}\right]^1\left[\frac{\frac{n}{v}}{2}\right]^2$

$= '8'\ K\left[\frac{n}{v}\right]^1\left[\frac{n}{v}\right]^2$

'8'times increases

36. The correct IUPAC name of 

a) 4-Ethyl-1-Fluoro-2-nitrobenzene

b) 1-Ethyl-4-Fluoro-3-nitrobenzene

c) 3-Ethyl-6-Fluoronitrobenzene

d) 5-Ethyl-2-Fluoronitrobenzene

Ans. **a**

Sol. Conceptual

37. Higher order (>3) reactions are rare due to

a) Shifting of equilibrium towards reactants due to elastic collisions

b) Loss of active species on collision

c) Low probability of simultaneous collision of all reacting species

d) Increase in entropy as more molecules are involved

Ans. **c**

Sol. Conceptual

38. Arrange benzene, n-hexane and ethyne in decreasing order of their acidic behaviour

a) Benzene > n-hexane > ethyne

b) n-hexane > Benzene > ethyne

c) ethyne > n-hexane > Benzene

d) ethyne > Benzene > n-hexane

Ans. **d**

Sol. Conceptual

39. A colloidal solution is subjected to an electric field than colloidal particles more towards anode. The amount of electrolytes of $BaCl_2, AlCl_3$ and NaCl required to coagulate the given colloid is in the order

a) $NaCl > BaCl_2 > AlCl_3$

b) $BaCl_2 < AlCl_3 > NaCl$

c) $AlCl_3 = NaCl = BaCl_2$

d) $AlCl_3 > BaCl_2 > NaCl$

Ans. a

Sol. As ions are moving toward anode i.e. negatively charged colloid

Coagulation value $\propto \frac{1}{\text{cogulating power}}$

$\therefore Na^{+1} > Ba^{+2} > Al^{+3}$

40. Which of the following is an incorrect statement?

a) Hydrogen bonding is stronger than dispersion forces

b) Sigma bonds are stronger than π-bonds

c) Ionic bonding is non-directional

d) σ-electrons are referred to as mobile electrons

Ans. d

Sol. Conceptual

41. Zeta potential is

a) Potential required to bring about coagulation of a colloidal sol.

b) Potential required to give the particle a speed of 1 cm S^{-1}

c) Potential difference between fixed charged layer and the diffused layer having opposite charges

d) Potential energy of the colloidal particles.

Ans. c

Sol. Conceptual

42. Which of the following compound on heating gives N_2O ?

a) $Pb(NO_3)_2$ b) NH_4NO_3

c) NH_4NO_2 d) $NaNO_3$

Ans. b

Sol. Conceptual

43. Which of the following property is true for the given sequence

$NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$?

a) Reducing property b) Thermal stability

c) Bond angle d) Acidic character

Ans. b

Sol. Conceptual

44. The correct order of boiling point in the following compounds is

a) $HF > H_2O > NH_3$ b) $H_2O > HF > NH_3$

c) $NH_3 > H_2O > HF$ d) $NH_3 > HF > H_2O$

Ans. b

Sol. Conceptual

45. XeF_6 on partial hydrolysis gives a compound X, which has square pyramidal geometry 'X' is

a) XeO_3 b) XeO_4 c) $XeOF_4$ d) XeO_2F_2

Ans. c

Sol. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF\,(XeOF_4 - \text{square pyramidal})$

$XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF\,(XeO_2F_2 - \text{See} - \text{saw})$

46. A colourless, neutral, paramagnetic oxide of Nitrogen 'P' on oxidation gives reddish brown gas Q. Q on cooling gives colourless gas R. R on reaction with P gives blue solid S. Identify P, Q, R, S respectively

a) N_2O NO $NO_2 N_2O_5$ b) N_2O NO_2 $N_2O_4 N_2O_3$

c) NO NO_2 $N_2O_4 N_2O_3$ d) NO NO $N_2O_4 N_2O_5$

Ans. c

Sol. $\underset{P}{2NO} + O_2 \rightarrow \underset{Q}{2NO_2} \rightarrow \underset{R}{N_2O_4} \xrightarrow{2NO} \underset{S}{2N_2O_3}$

47. Which of the following does not represent property stated against it?

a) $CO^{+2} < Fe^{+2} < Mn^{+2}$ - Ionic size

b) Ti < V < Mn - Number of oxidation states

c) $Cr^{+2} < Mn^{+2} < Fe^{+2}$ – Paramagnetic behaviour

d) Sc > Cr > Fe – Density

Ans. c

Sol. Conceptual

48. Which one of the following is correct for all elements from Sc to Cu?
a) The lowest oxidation state shown by them is +2
b) 4S orbital is completely filled in the ground state
c) 3d orbital is not completely filled in the ground state
d) The ions in +2 oxidation states are paramagnetic

Ans. d

Sol. Conceptual

49. When the absolute temperature of ideal gas is doubled and pressure is halved, the volume of gas
a) will be half of original volume
b) will be 4 times the original volume
c) will be 2 times the original volume
d) will be $1/4^{th}$ times the original volume

Ans. b

Sol. $PV = nRT$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad \frac{P \times V_1}{T} = \frac{P}{2} \times \frac{V_2}{2T}$ $\quad V_2 = 4V_1$

50. Which of the following pairs has both the ions coloured in aqueous solution? [Atomic numbers of
$[Sc = 21, Ti = 22, Ni = 28, Cu = 29, Mn = 25]$
a) Sc^{3+}, Mn^{2+} b) Ni^{2+}, Ti^{4+}
c) Ti^{3+}, Cu^{+} d) Mn^{2+}, Ti^{3+}

Ans. d

Sol. Conceptual

51. For the crystal field splitting in octahedral complexes,
a) the energy of the e_g orbitals will decrease by $(3/5)\Delta_0$ and that of the t_{2g} will increase by $(2/5)\Delta_0$
b) the energy of the e_g orbitals will increase by $(3/5)\Delta_0$ and that of the t_{2g} will decrease by $(2/5)\Delta_0$
c) the energy of the e_g orbitals will increase by $(3/5)\Delta_0$ and that of the t_{2g} will increase by $(2/5)\Delta_0$
d) the energy of the e_g orbitals will decrease by $(3/5)\Delta_0$ and that of the t_{2g} will decrease by $(2/5)\Delta_0$

Ans. b

Sol. Conceptual

52. Peroxide effect is observed with the addition of HBr but not with the addition of HI to unsymmetrical alkene because
a) H-I bond is stronger that H-Br and is not cleaved by the free radical
b) H-I bond is weaker than H-Br bond so that iodine free radicals combine to form iodine molecules
c) Bond strength of HI and HBr are same but free radicals are formed in HBr
d) All of these

Ans. b

Sol. Conceptual

53. The IUPAC name of $[Co(NH_3)_5(CO_3)]Cl$ is
a) Pentaamminecarbonatocobalt (III) Chloride
b) Carbonatopentamminecobalt (III) Chloride
c) Pentaamminecarbonatocobaltate (III) Chloride
d) Pentaammine cobalt (III) Carbonate Chloride

Ans. a

Sol. Conceptual

54. Homoleptic complexes among the following are
A) $K_3[Al(C_2O_4)_3]$, B) $[CoCl_2(en)_2]^+$
C) $K_2[Zn(OH)_4]$
a) A only b) A and B only
c) A and C only d) C only

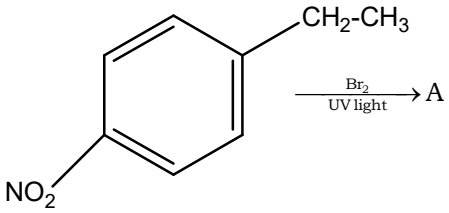
Ans. c

Sol. Conceptual

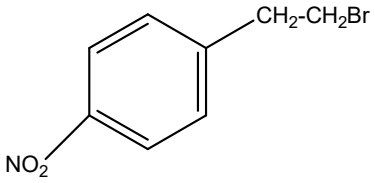
55. The correct order for wavelengths of light absorbed in the complex ions $[CoCl(NH_3)_5]^{2+}$, $[Co(NH_3)_6]^{3+}$ and $[Co(CN)_6]^{3-}$ is
a) $[CoCl(NH_3)_5]^{2+} > [Co(NH_3)_6]^{3+} > [Co(CN)_6]^{3-}$
b) $[Co(NH_3)_6]^{3+} > [Co(CN)_6]^{3-} > [CoCl(NH_3)_5]^{2+}$
c) $[Co(CN)_6]^{3-} > [CoCl(NH_3)_5]^{2+} > [Co(CN)_6]^{3-}$
d) $[Co(NH_3)_6]^{3+} > [CoCl(NH_3)_5] > [Co(CN)_6]^{3-}$

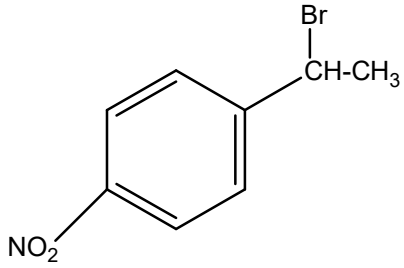
Ans. a

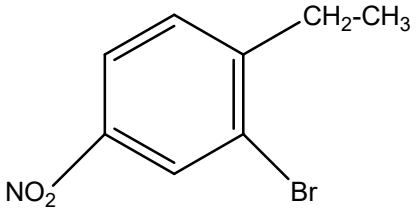
Sol. Wave length of light absorbed is inversely proportional to strength of the ligand.

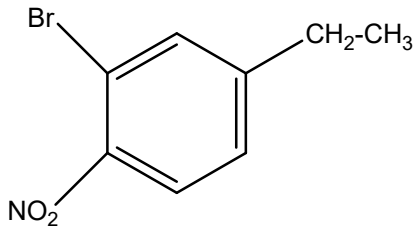
56. 

The compound A (major product) is

a) 

b) 

c) 

d) 

Ans. **b**

Sol. Free radical substitution of alkane part. (Benzyl free radical) takes place.

57. Bond enthalpies of A_2, B_2 and AB are in the ratio 2 : 1 : 2. If bond enthalpy of formation of AB is $-100 KJ\,mol^{-1}$. The bond enthalpy of B_2 is

a) $100\,KJ\ mol^{-1}$ b) $50\,KJ\ mol^{-1}$

c) $200\,KJ\ mol^{-1}$ d) $150\,KJ\ mol^{-1}$

Ans. **c**

Sol. Assume bond strength of $A_2 = 2X$, then,

$B_2 = X,\ AB = 2X$

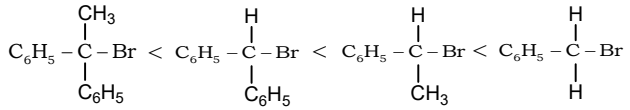
$\Delta_r H^{\Theta} = \sum \Delta_{diss} H^{\Theta}_{(R)} - \sum \Delta_{diss} H^{\Theta}_{(P)}$

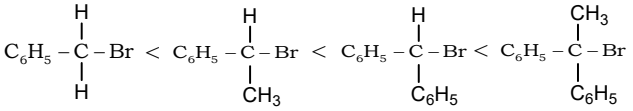
$\frac{1}{2}A_2 + \frac{1}{2}B_2 \rightarrow AB$

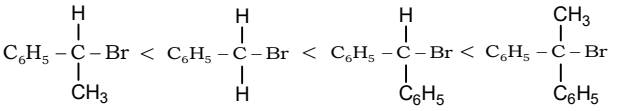
$-100 = \frac{1}{2}2X + \frac{1}{2}X - 2$

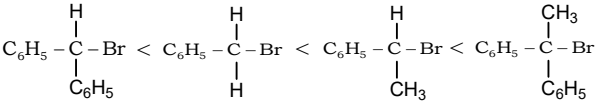
$X = 200$

58. The order of reactivity of the compounds $C_6H_5CH_2Br, C_6H_5CH(C_6H_5)Br, C_6H_5CH(CH_3)Br$ and $C_6H_5C(CH_3)(C_6H_5)Br$ in S_N^2 reaction is

a) 

b) 

c) 

d) 

Ans. **a**

Sol. Conceptual

59. The major product of the following reaction is

$CH_2 = CH - CH_2 - OH \xrightarrow[Excess]{HBr}$ Product

a) $CH_3 - CHBr - CH_2Br$

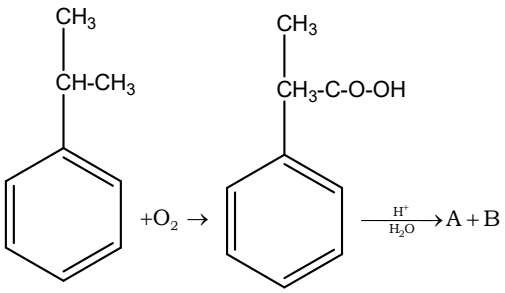
b) $CH_2 = CH - CH_2Br$

c) $CH_3 - CHBr - CH_2 - OH$

d) $CH_3 - CHOH - CH_2OH$

Ans. **a**

Sol. $CH_2 = CH - CH_2OH \xrightarrow[Excess]{HBr} CH_3CH(Br) - CH_2OH \xrightarrow{HBr} CH_3CH(Br) - CH_2Br$

60. 

The product 'A' gives white precipitate when treated with bromine water. The product 'B' is treated with Barium hydroxide to give the product C. The compound C is heated strongly to form product D. The product D is

a) 4-Methylpent-3-en-2-one

b) But-2 enal

c) 3-Methylpent-3-en-2-one

d) 2-Methylbut-2-enal

Ans. **a**

Sol. A is phenol

B is acetone

Acetone when treated with $Ba(OH)_2$ Undergoes aldol condensation and followed by heating gives 4-methylpent -3-en-2-one

KCET EXAMINATION – 2021
SUBJECT : MATHEMATICS (VERSION – A3)

DATE :- 28-08-2021 **TIME : 02.30 PM TO 03.50 PM**

1. The equation of the line joining the points $(-3,4,11)$ and $(1,-2,7)$ is

a) $\frac{x+3}{2}=\frac{y-4}{3}=\frac{z-11}{4}$

b) $\frac{x+3}{-2}=\frac{y-4}{3}=\frac{z-11}{2}$

c) $\frac{x+3}{-2}=\frac{y+4}{3}=\frac{z+11}{4}$

d) $\frac{x+3}{2}=\frac{y+4}{-3}=\frac{z+11}{2}$

Ans. **b**

Sol. A(-3, 4, 11) B(1, -2, 7) Dr's of AB
(a, b, c)=1-(-3), (-2, -4) 7, -11
4, -6, -4
=-2, 3, 2

2. The angle between the lines whose direction cosines are $\left(\frac{\sqrt{3}}{4},\frac{1}{4},\frac{\sqrt{3}}{2}\right)$ and $\left(\frac{\sqrt{3}}{4},\frac{1}{4},\frac{-\sqrt{3}}{2}\right)$ is

a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{4}$

Ans. **c**

Sol. $\cos\theta=\left|\frac{\sqrt{3}}{4}\times\frac{\sqrt{3}}{4}+\frac{1}{4}\times\frac{1}{4}-\frac{\sqrt{3}}{2}\times\frac{\sqrt{3}}{2}\right|=\left(\frac{-1}{2}\right),\ \theta=\frac{\pi}{3}$

3. If a plane meets the coordinate axes at A, B and C in such a way that the centroid of triangle ABC is at the point $(1,2,3)$ then the equation of the plane is

a) $\frac{x}{1}+\frac{y}{2}+\frac{z}{3}=1$ b) $\frac{x}{3}+\frac{y}{6}+\frac{z}{9}=1$

c) $\frac{x}{1}+\frac{y}{2}+\frac{z}{3}=\frac{1}{3}$ d) $\frac{x}{1}-\frac{y}{2}+\frac{z}{3}=-1$

Ans. **b**

Sol. (1, 2, 3)= $\left(\frac{a}{3},\frac{b}{3},\frac{c}{3}\right)$, a=3, b=6, c=9

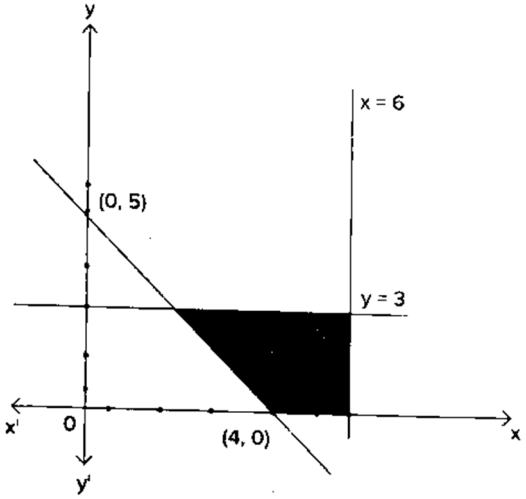
4. The area of the quadrilateral ABCD when $A(0,4,1)B(4,5,0)$ and $D(2,6,2)$ is equal to

a) 9 sq.units b) 18 sq.units
c) 27 sq.units d) 81 sq.units

Ans. **a**

Sol. $\frac{1}{2}\left(\overline{AC}\times\overline{BD}\right)=9\text{sq.units}$

5. The shaded region is the solution set of the inequalities



a) $5x+4y\geq 20, x\leq 6, y\geq 3, x\geq 0, y\geq 0$

b) $5x+4y\leq 20, x\leq 6, y\leq 3, x\geq 0, y\geq 0$

c) $5x+4y\geq 20, x\leq 6, y\leq 3, x\geq 0, y\geq 0$

d) $5x+4y\geq 20, x\geq 6, y\leq 3, x\geq 0, y\geq 0$

Ans. **c**

Sol. $x\leq 6,\ y\leq 3,\ 5x+4y\geq 20$

6. Given that A and B are two events such that $P(B)=\frac{3}{5}$, $P\left(\frac{A}{B}\right)=\frac{1}{2}$ and $P(A\cup B)=\frac{4}{5}$ then $P(A)=$

a) $\frac{3}{10}$ b) $\frac{1}{2}$ c) $\frac{1}{5}$ d) $\frac{3}{5}$

Ans. **b**

Sol. $\frac{1}{2}=\mathrm{P}\frac{(\mathrm{A}\cap\mathrm{B})}{\frac{3}{5}}\Rightarrow\mathrm{P}(\mathrm{A}\cap\mathrm{B})=\frac{3}{10}$

$\frac{4}{5}=\frac{3}{5}+\mathrm{P}(\mathrm{A})-\frac{3}{10}\Rightarrow\mathrm{P}(\mathrm{A})=\frac{1}{2}$

7. If A, B and C are three independent events such that $P(A)=P(B)=P(C)=P$ then P (at least two of A, B, C occur) =

a) P^3-3P b) $3P-2P^2$ c) $3P^2-2P^3$ d) $3P^2$

Ans. **c**

Sol. $\mathrm{P(A)=P(B)=P(C)=P}$

$\mathrm{P(A).P(B).P(C)+3.P^2(1-p)}$

$\mathrm{P^3+3p^2(1-P)=3P^2-2P^3}$

8. Two dice are thrown. If it is known that the sum of numbers on the dice was less than 6 the probability of getting a sum as 3 is

a) $\frac{1}{18}$ b) $\frac{5}{18}$ c) $\frac{1}{5}$ d) $\frac{2}{5}$

Ans. c

Sol. (1, 1) (1, 2) (1, 3) (1, 4) (2, 1) (2, 2) (2, 3) (3, 1) (3, 2) (4, 1) P(B)= $\frac{10}{36}$

$n(A)=(1,2)(2,1)$ $P(A)=\frac{2}{36}$

$P\left(\frac{B}{A}\right)=\frac{\frac{2}{36}}{\frac{10}{36}}=\frac{2}{10}=\frac{1}{5}$

9. A car manufacturing factory has two plants X and Y. Plant X manufactures 70% of cars and plant Y manufactures 30% of cars. 80% of cars at plant X and 90% of cars at plant Y are rated as standard quality. A car is chosen at random and is found to be standard quality. The probability that it has come from plant X is

a) $\frac{56}{73}$ b) $\frac{56}{84}$ c) $\frac{56}{83}$ d) $\frac{56}{79}$

Ans. c

Sol. $=\frac{\frac{70}{100}\times\frac{80}{100}}{\frac{70}{100}\times\frac{80}{100}+\frac{90}{100}\times\frac{30}{100}}=\frac{56}{83}$

10. In a certain two 65% families own cell phones, 15000 families own scooter and 15% families own both. Taking into consideration that the families own at least one of the two, the total number of families in the town is

a) 20000 b) 30000 c) 40000 d) 50000

Ans. b

Sol. $x=\frac{65x}{100}+15000-\frac{15x}{100}$ =30,000

11. A and B are non-singleton sets and $n(A\times B)=35$. If $B\subset A$ then ${}^{n(A)}C_{n(B)}=$

a) 28 b) 35 c) 42 d) 21

Ans. d

Sol. $n(A\times B)=35=7\times5,\ 7_{C_5}=7_{C_2}=21$

12. Domain of $f(x)=\frac{x}{1-|x|}$ is

a) $R-[-1,1]$ b) $(-\infty,1)$

c) $(-\infty,1)\cup(0,1)$ d) $R-\{-1,1\}$

Ans. d

Sol. $|x|\neq1$

13. The value of $\cos1200^0+\tan1485^0$ is

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

Ans. a

Sol. $\cos\left(3\times360^0+120^0\right)+\tan\left(4\times360^0+45^0\right)$

=1/2

14. The value of $\tan1^0\tan2^0\tan3^0....\tan89^0$ is

a) 0 b) 1 c) $\frac{1}{2}$ d) −1

Ans. b

Sol. $\tan\theta.\cot\theta=1$

15. If $\left(\frac{1+i}{1-i}\right)^x=1$ then

a) $x=4n+1;n\in N$ b) $x=2n+1;n\in N$

c) $x=2n;n\in N$ d) $x=4n;n\in N$

Ans. d

Sol. $\left(\frac{1+i}{1-i}\right)^x=1\Rightarrow i^x=1$

16. The cost and revenue functions of a product are given by $c(x)=20x+4000$ and $R(x)=60x+2000$ respectively where x is the number of items produced and sold. The value of x

> > > >

Ans. a

Sol. $R(x)-c(x)>0$; $60x+2000-20x-4000>0$

$x>50$

17. A student has to answer 10 questions, choosing at least 4 from each of the parts A and B. If there are 6 questions in part A and 7 in part B, then the number of ways can the student choose 10 questions is

a) 256 b) 352 c) 266 d) 426

Ans. c

Sol. ${}^{13}C_{10}-{}^{6}C_3=286-20=266$

18. If the middle term of the A.P is 300 then the sum of its first 51 terms is

a) 15300 b) 14800 c) 16500 d) 14300

Ans. a

Sol. mid term is $T_{26}=300$

$T_1=300-25d$; $T_{51}=300+25d$

$S=\frac{51}{}[300-25d+300+25d]$

$\frac{51}{}[600]=15,300$

19. The equation of straight line which passes through the point ($a\cos^3\theta$, $a\sin^3\theta$) and perpendicular to $x\sec\theta+y\operatorname{cosec}\theta=a$ is

a) $\frac{x}{a}+\frac{y}{a}=a\cos\theta$ b) $x\cos\theta-y\sin\theta=a\cos2\theta$

c) $x\cos\theta+y\sin\theta=a\cos2\theta$ d) $x\cos\theta-y\sin\theta=-a\cos2\theta$

Ans. b

Sol. $\frac{x}{\sin\theta}-\frac{y}{\cos\theta}=\frac{a\cos^3\theta}{\sin\theta}-\frac{a\sin^3\theta}{\cos\theta}$

$\frac{x\cos\theta-y\sin\theta}{\sin\theta\cos\theta}=\frac{a(\cos2\theta)}{\sin\theta\cos\theta}$

$x\cos\theta-y\sin\theta=a\cos2\theta$

20. The mid points of the sides of triangle are (1, 5, -1) (0, 4, -2) and (2, 3, 4) then centroid of the triangle

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

Ans. b

Sol. $\left(\frac{1+0+2}{3},\frac{5+4+3}{3},\frac{-1-2+4}{3}\right)$

$\left(1,4,\frac{1}{3}\right)$

21. Consider the following statements :

Statement 1 :

$\lim\limits_{x\to1}\frac{ax^2+bx+c}{cx^2+bx+a}$ is 1 (where $a+b+c\neq0$)

Statement 2 : $\lim\limits_{x\to-2}\frac{\frac{1}{x}+\frac{1}{2}}{x+2}$ is $\frac{1}{4}$

a) Only statement 2 is true

b) Only statement 1 is true

c) Both statements 1 and 2 are true

d) Both statements 1 and 2 are false

Ans. b

Sol. statement 1 is true

Statement 2 is false

$\left[\frac{a+b+c}{a+b+c}=1\right]$

$\lim\limits_{x\to-2}\frac{\frac{1}{x}+\frac{1}{2}}{x+2}$ is $-\frac{1}{4}$

22. If a and b are fixed non-zero constants, then the derivative of $\frac{a}{x^4}-\frac{b}{x^2}+\text{Cosx}$ is ma+nb-p where

a) $m=4x^3;\ n=\frac{-2}{x^3};\ p=\sin x$

b) $m=\frac{-4}{x^5};\ n=\frac{2}{x^3};\ p=\sin x$

c) $m=\frac{-4}{x^5};\ n=\frac{-2}{x^3};\ p=-\sin x$

d) $m=4x^3;\ n=\frac{2}{x^3};\ p=-\sin x$

Ans. b

Sol. $\frac{d}{dx}\left(\frac{a}{x^4}-\frac{b}{x^2}+\cos x\right)=\left(-\frac{4a}{x^5}+\frac{2b}{x^3}-\sin x\right)$

$=ma+nb-p$

$m=-\frac{4}{x^5};n=\frac{+2}{x^3};p=\sin x$

23. The Standard Deviation of the numbers 31, 32, 33..... 46, 47 is

a) $\sqrt{\frac{17}{12}}$ b) $\sqrt{\frac{47^2-1}{12}}$ c) $2\sqrt{6}$ d) $4\sqrt{3}$

Ans. c

Sol. $\text{S.D.}=\sqrt{\frac{n^2-1}{12}}(n=17)$

$=\sqrt{\frac{17^2-1}{12}}$

$=2\sqrt{6}$

24. If P(A)=0.59, P(B)=0.30 and P(A∩B)=0.21 then $P(A'\cap B')=$

a) 0.11 b) 0.38 c) 0.32 d) 0.35

Ans. c

Sol. $P(A^1\cap B^1)=1-P(A\cup B)$

$=1-[0.59+0.3-0.21]$

=0.32

25. f:R→R defined by f(x)=

$\begin{cases}2x;x>3\\x^2;1<x\le3\\3x;x\le1\end{cases}$ then $f(-2)+f(3)+f(4)$ is

a) 14 b) 9 c) 5 d) 11

Ans. d

Sol. $f(-2)+f(3)+f(4)$

$-6+9+8$

26. Let A={x:x∈R ; x is not a positive integer)
Define f:A→R as f(x)= $\frac{2x}{x-1}$, then f is
a) injective but not surjective
b) surjective but not injective
c) bijective
d) neither injective nor surjective

Ans. a

Sol. $f'(x)=\frac{-2}{(x-1)^2}<0$

f is s.d.
f is one-one
$\frac{2x}{x-1}=y\Rightarrow x=\frac{y}{y-2}\notin \pi$ for $y=2$
f is not out

27. The function f(x)= $\sqrt{3}$ sin2x-cos2x+4 is one-one in the interval
a) $\left[\frac{-\pi}{6},\frac{\pi}{3}\right]$ b) $\left[\frac{\pi}{6},\frac{-\pi}{3}\right]$ c) $\left[\frac{-\pi}{2},\frac{\pi}{2}\right]$ d) $\left[\frac{-\pi}{6},\frac{-\pi}{3}\right]$

Ans. a

Sol. $f=\sqrt{3}\sin 2x-\cos 2x+4=2\left[\sin\left(2x-\frac{\pi}{6}\right)\right]+4$

f is one-one
$-\frac{\pi}{2}\le 2x-\frac{\pi}{6}\le\frac{\pi}{2}$
$\Rightarrow -\frac{\pi}{6}\le x\le\frac{\pi}{3}$
$\left[-\frac{\pi}{6},\frac{\pi}{3}\right]$

28. Domain of the function f(x)= $\frac{1}{\sqrt{[x^2]-[x]-6}}$
where [x] is greatest integer ≤ x is
a) $(-\infty,2)\cup[4,\infty]$ b) $(-\infty,-2)\cup[3,\infty]$
c) $[-\infty,-2]\cup[4,\infty]$ d) $[-\infty,2]\cup[3,\infty]$

Ans. a

Sol. $[x^2]-[x]-6>0$ $([x]-3)([x]+2)>0$
$[x]<-2,[x]>3\Rightarrow x\in(-\infty,-2)\cup[4,\infty)$

29. $\cos\left[\cot^{-1}\left(-\sqrt{3}\right)+\frac{\pi}{6}\right]=$
a) 0 b) 1 c) $\frac{1}{\sqrt{2}}$ d) -1

Ans. d

Sol. $\cos\left(\pi-\frac{\pi}{6}+\frac{\pi}{6}\right)=\cos\pi=-1$

30. $\tan^{-1}\left[\frac{1}{\sqrt{3}}\sin\frac{5\pi}{2}\right]\sin^{-1}\left[\cos\left(\sin^{-1}\frac{\sqrt{3}}{2}\right)\right]=$
a) 0 b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) π

Ans. GRACE

Sol. $\left(\frac{\pi}{6}\right)^2$

31. If $A=\begin{bmatrix}1&-2&1\\2&1&3\end{bmatrix}B=\begin{bmatrix}2&1\\3&2\\1&1\end{bmatrix}$ then $(AB)'$
[– –] [–] c) $\begin{bmatrix}-3&7\\10&2\end{bmatrix}$ d) $\begin{bmatrix}-3&7\\10&-2\end{bmatrix}$

Ans. b

Sol. $AB=\begin{pmatrix}-3&-2\\10&7\end{pmatrix}$
$(\quad)^T\quad(-3\quad 10)$

32. Let M be 2 x 2 symmetric matrix with integer entries, then M is invertible if
a) the first column of M is the transpose of second row of M
b) the second row of M is the transpose of first column of M
c) M is diagonal matrix with non-zero entries in the principal diagonal
d) The product of entries in the principal diagonal of M is the product of entries in the other diagonal

Ans. c

Sol. $m=\begin{pmatrix}a&0\\0&a\end{pmatrix}$
m

33. If A and B are matrices of order 3 and |A|=5, |B|=3 then |3AB| is
a) 425 b) 405 c) 565 d) 585

Ans. b

Sol. $|3AB|=3^3|AB|$
$=27\times3\times5$
=

34. If A and B are invertible matrices then which of the following is not correct ?
a) adjA= $|A|A^{-1}$ b) det $(A^{-1})=[\det(A)]^{-1}$
c) $(AB)^{-1}=B^{-1}A^{-1}$ d) $(A+B)^{-1}=B^{-1}+A^{-1}$

Ans. d

Sol. $(A+B)^{-1}=B^{-1}+A^{-1}$

35. If $f(x)=\begin{vmatrix}\cos x & 1 & 0\\ 0 & 2\cos x & 3\\ 0 & 1 & 2\cos x\end{vmatrix}$ then $\lim_{x\to\pi} f(x) =$

a) -1 b) 1 c) 0 d) 3

Ans. a

Sol. $f(x)=4\cos^3 x-3\cos x$

$=\cos 3x$

$\lim_{x\to\pi}\cos 3x=\cos 3\pi$

$=-1$

36. If $x^3-2x^2-9x+18=0$ and $A=\begin{vmatrix}1 & 2 & 3\\ 4 & x & 6\\ 7 & 8 & 9\end{vmatrix}$ then the maximum value of A is

a) 96 b) 36 c) 24 d) 120

Ans. a

Sol. $(x-2)(x^2-9)=0$

$x=2,3,-3$

$f(x)=|A|=-12x+60$

Max value at $x=-3$

$\therefore |A|=96$

37. At x=1, the function f(x)= $\begin{cases}x^3-1 & 1<x<\infty\\ x-1 & -\infty<x\le 1\end{cases}$ is

a) continuous and differentiable

b) continuous and non-differentiable

c) discontinuous and differentiable

d) discontinuous and non-differentiable

Ans. b

Sol. $\lim_{x\to 1+} x^3-1=0$

$\lim_{x\to 1-}(x-1)=0$

F is continuous

$f'(x)=\begin{cases}3x^2 & 1<x<\infty\\ 1 & -\infty<x<\end{cases}$

$f'(1^+)=3, f'(1^-)=1$

$\Rightarrow$ f is not differentiable

38. If $y=(\cos x^2)^2$, then $\frac{dy}{dx}$ is equal to

a) -4x sin2x² b) -x sin x²

c) -2x sin 2x² d) -x cos2x²

Ans. c

Sol. $\frac{dy}{dx}=2\cos x^2.(-\sin x^2)2x$

$=-2x\sin(2x^2)$

39. For constant a, $\frac{d}{dx}(x^x+x^a+a^x+a^a)$ is

a) $x^x(1+\log x)+ax^{a-1}$

b) $x^x(1+\log x)+ax^{a-1}+a^x\log a$

c) $x^x(1+\log x)+a^a(1+\log x)$

d) $x^x(1+\log x)+a^a(1+\log a)+ax^{a-1}$

Ans. b

Sol. $\frac{d}{dx}(x^x+x^a+a^x+a^a)$

40. Consider the following statements :

Statement 1 :

If $y=\log_{10}x+\log_e x$ then $\frac{dy}{dx}=\frac{\log_{10}e}{x}+\frac{1}{x}$

Statement 2 :

If $\frac{d}{dx}(\log_{10}x)=\frac{\log x}{\log 10}$ and $\frac{d}{dx}(\log_e x)=\frac{\log x}{\log e}$

a) Statement 1 is true ; Statement 2 is false

b) Statement 1 is false ; statement 2 is true

c) Both statements 1 and 2 are true

d) Both statements 1 and 2 are false

Ans. a

Sol. $x^x(1+\log x)+ax^{a-1}+a^x\log_e^a$

$y=\frac{\log x}{}+\log x$

$\frac{dy}{dx}=\frac{1}{x\log 10}+\frac{1}{x}$

41. If the parametric equation of curve is given by

$x=\cos\theta+\log\tan\frac{\theta}{2}$ and $y=\sin\theta$

— =

$\theta=\frac{\pi}{}\quad\in$ b) $\theta=(2n+1)\frac{\pi}{2}, n\in z$

c) $\theta=(2n+1)\pi, n\in z$ $\theta=\ \pi\ \in$

Ans. d

Sol. $\frac{dx}{}\quad\frac{1}{}\quad{}_2\left(\frac{\theta}{}\right)\frac{1}{}$

—

$=-\sin\theta+\frac{1}{2\sin\left(\frac{\theta}{2}\right)\cos\left(\frac{\theta}{2}\right)}=-\sin\theta+\frac{1}{\sin\theta}$

$=\frac{1-\sin^2\theta}{\sin\theta}; \frac{dx}{d\theta}=\frac{\cos^2\theta}{\sin\theta}; \frac{dy}{\theta}=\cos\theta$

$\frac{dy}{}=0\qquad\theta=$

$\theta=\ \pi\ \in$

42. If $y=(x-1)^2(x-2)^3(x-3)^5$ then $\frac{dy}{dx}$ at $x=4$ is equal to

a) 108 b) 54 c) 36 d) 516

Ans. d

Sol. $\log y = 2\log(x-1)+3\log(x-2)+5\log(x-3)$

$$\frac{dy}{dx}=(x-1)^2(x-2)^2(x-3)^5\left[\frac{2}{x-1}+\frac{3}{x-2}+\frac{5}{x-3}\right]$$

$$\left(\frac{dy}{dx}\right)_{x=4}=516$$

43. A particle starts form rest and its angular displacement (in radians) is given by $\theta=\frac{t^2}{20}+\frac{t}{5}$. If the angular velocity at the end of t = 4 is k, then the value of 5k is

a) 0.6 b) 5 c) 5k d) 3

Ans. d

Sol. $\frac{d\theta}{dt}=\frac{2t}{20}+\frac{1}{5}$

$$=\frac{t}{10}+\frac{1}{5}$$

$$\left(\frac{d\theta}{dt}\right)_{\varepsilon=4}=\frac{4}{10}+\frac{1}{5}$$

$$k=\frac{3}{5}$$

$$5k=3$$

44. If the parabola $y=\alpha x^2-6x+\beta$ passes through the point $(0,2)$ and has its tangent at $x=\frac{3}{2}$ parallel to x axis, then

a) $\alpha=2,\beta=-2$ b) $\alpha=-2,\beta=2$

c) $\alpha=2,\beta=2$ d) $\alpha=-2,\beta=-2$

Ans. c

Sol. $y=\alpha x^2-6x+\beta$ passes through $(0,2)$

$$2=\beta$$

$$\frac{dy}{dx}=2\alpha x-6$$

$$\left(\frac{dy}{dx}\right)_{x=\frac{3}{2}}=0$$

$$2\alpha\left(\frac{3}{2}\right)-6=0$$

$$3\alpha=6$$

$$\alpha=2$$

45. The function $f(x)=x^2-2x$ is strictly decreasing in the interval

a) $(-\infty,1)$ b) $(1,\infty)$ c) R d) $(-\infty,\infty)$

Ans. a

Sol. $f'(x)<0$; $2(x-1)<0$

$x<1$; $x\in(-\infty,\ 1)$

46. The maximum slope of the curve $y=-x^3+3x^2+2x-27$ is

a) 1 b) 23 c) 5 d) -23

Ans. c

Sol. Slope $m=\frac{dy}{dx}=-3x^2+6x+2$

$$\frac{dm}{dx}=0 \quad ; \quad -6x+6=0$$

$$x=1 \quad ; \quad m=-3+6+2=5$$

47. $\int\frac{(\ \ ^{-}(\ \ ))}{+}$ is equal to

a) $\frac{-\cos\left(\tan^{-1}(x^4)\right)}{4}+C$ b) $\frac{(\ \ ^{-}(\ \ ))}{}+$

c) $\frac{-\ \ (\ \ ^{-}(\ \ ))}{}+$ d) $\frac{(\ \ ^{-}(\ \ ))}{}+$

Ans. a

Sol. $\mathrm{Tan}^{-1}x^4=t$; $\frac{4x^3}{1+x^8}dx=dt$

$$I=\frac{1}{4}\int\sin t\,dt=\frac{-1}{4}\cos t+c=\frac{-1}{4}\cos\left(\mathrm{Tan}^{-1}x^4\right)+c$$

48. The value of $\int\frac{x^2dx}{\sqrt{x^6+a^6}}$ is equal to

a) $\log\left|x^3+\sqrt{x^6+a^6}\right|+c$

$\left|\ \ -\sqrt{\ \ \ \ }+\right|+$

$-\ \ \left|\ \ +\sqrt{\ \ \ \ }+\right|+$

$-\ \ \left|\ \ -\sqrt{\ \ \ \ }+\right|+$

Ans. c

Sol. $x^3=t \quad 3x^2dx=dt$

$$I=\frac{1}{}\int\frac{1}{\sqrt{^2\ \ (\ \ ^3)^2}}dt=\frac{1}{}\log\left[t+\sqrt{t^2+a^6}\right]$$

$-\ \ \ ^3\sqrt{^6\ \ ^6}$

49. The value of $\int \frac{xe^x dx}{(1+x)^2}$ is equal to

a) $e^x(1+x)+c$ b) $e^x(1+x^2)+c$

c) $e^x(1+x)^2+c$ d) $\frac{e^x}{1+x}+c$

Ans. d

Sol. $\int \frac{(x+1-1)e^x}{(1+x)^2}dx = \int e^x\left(\frac{1}{1+x}-\frac{1}{(1+x)^2}\right)dx$

$= \frac{e^x}{1+x}+c$

50. The value of $\int e^x\left[\frac{1+\sin x}{1+\cos x}\right]dx$ is equal to

a) $e^x \tan\frac{x}{2}+c$ b) $e^x \tan x+c$

c) $e^x(1+\cos x)+c$ d) $e^x(1+\sin x)+c$

Ans. a

Sol. $\int e^x\left(\frac{1+2\sin\frac{x}{2}\cos\frac{x}{2}}{2\cos^2\frac{x}{2}}\right)dx$

$= \int e^x\left(\frac{1}{2}\sec^2\frac{x}{2}+\text{Tan}\frac{x}{2}\right)dx$

$= e^x \text{Tan}\frac{x}{2}+c$

51. If $I_n = \int_0^{\frac{\pi}{4}} \tan^n x\,dx$ where n is positive integer then $I_{10}+I_8$ is equal to

a) 9 b) $\frac{1}{7}$ c) $\frac{1}{8}$ d) $\frac{1}{9}$

Ans. d

Sol. $I_n + I_{n-2} = \frac{1}{n-1}$

52. The value of $\int_0^{4042} \frac{\sqrt{x}\,dx}{\sqrt{x}+\sqrt{4042-x}}$ is equal to

a) 4042 b) 2021 c) 8084 d) 1010

Ans. b

Sol. $\int_a^b \frac{f(x)}{f(x)+f(a+b-x)}dx = \frac{b-a}{2}$

53. The area of the region bounded by $y=\sqrt{16-x^2}$ and x-axis is

a) 8 square units b) 20π square units

c) 16π square units d) 256π square units

Ans. a

Sol. $x^2+y^2=16$

$\frac{1}{2}\pi(4)^2 = 8\pi$

54. If the area of the Ellipse is $\frac{x^2}{}+\frac{y^2}{\lambda^2}=1$ is 20π

λ

$\pm$ $\pm$ $\pm$ $\pm$

Ans. a

Sol. $\frac{x^2}{}+\frac{y^2}{\lambda^2}=1$

$\pi ab = \pi.5.|\lambda| = 20\pi$

$|\lambda| = \quad \Rightarrow \lambda = \pm$

55. Solution of Differential Equating xdy – ydx = 0 represents

a) A rectangular Hyperbola

b) Parabola whose vertex is at origin

c) Straight line passing through origin

d) A circle whose centre is origin

Ans. c

Sol. $xdy = ydx$

$\frac{dy}{dx} = \frac{y}{x}$

$= —$

$=$

56. The number of solutions of $\frac{dy}{dx} = \frac{y+1}{x-1}$ when $y(1)=2$

Ans. b

Sol. One solution

57. A vector $\vec{a}$ makes equal acute angles on the coordinate axis. Then the projection of vector $\vec{b} = 5\hat{i} + 7\hat{j} + \hat{k}$ on $\vec{a}$ is

a) $\frac{11}{15}$ b) $\frac{11}{\sqrt{3}}$ c) $\frac{4}{5}$ d) $\frac{3}{5\sqrt{3}}$

Ans. b

Sol. $\bar{a} = \hat{i} + \hat{j} + \hat{k}$

$$\frac{\bar{b}.\bar{a}}{|\bar{a}|} = \frac{5+7-1}{\sqrt{3}} = \frac{11}{\sqrt{3}}$$

58. The diagonals of a parallelogram are the vectors $3\hat{i} + 6\hat{j} - 2\hat{k}$ and $-\hat{i} - 2\hat{j} - 8\hat{k}$ then the length of the shorter side of parallelogram is

a) $2\sqrt{3}$ b) $\sqrt{14}$ c) $3\sqrt{5}$ d) $4\sqrt{3}$

Ans. GRACE

Sol. $\bar{a} = \frac{\bar{d}_1 + \bar{d}_2}{2} = \frac{2i + 4j - 10k}{2} = i + 2j - 5k$

$$|\bar{a}| = \sqrt{30}$$

$$|\bar{b}| = \frac{\bar{d}_1 - \bar{d}_2}{2} = \frac{4i + 8j + 6k}{2} = 2i + 4j + 3k$$

$$|\bar{b}| = \frac{2}{\sqrt{4+16+9}} = \sqrt{29}$$

59. If $\vec{a}.\vec{b} = 0$ and $\vec{a} + \vec{b}$ makes an angle 60° with $\vec{a}$ then

a) $|\vec{a}| = 2|\vec{b}|$ b) $2|\vec{a}| = |\vec{b}|$

c) $|\vec{a}| = \sqrt{3}|\vec{b}|$ d) $\sqrt{3}|\vec{a}| = |\vec{b}|$

Ans. d

Sol. $\cos 60 = \frac{(\bar{a} + \bar{b}).\bar{a}}{|\bar{a} + \bar{b}|\,|\bar{a}|} = \frac{|\bar{a}|^2 + 0}{\sqrt{|\bar{a}|^2 + |\bar{b}|^2}} =$

$$\frac{1}{2} = \frac{|\bar{a}|}{\sqrt{|\bar{a}|^2 + |\bar{b}|^2}}$$

$$|\bar{a}|^2 + |\bar{b}|^2 = 4|\bar{a}|^2$$

$$|\bar{b}|^2 = 3|\bar{a}|^2$$

$$|\bar{b}| = \sqrt{3}|\bar{a}|$$

60. If the area of the parallelogram with a and b as two adjacent sides is 15 sq. units then the area of the parallelogram having $3\vec{a} + 2\vec{b}$ and $\vec{a} + 3\vec{b}$ as two adjacent sides in sq. units is

a) 45 b) 75 c) 105 d) 120

Ans. c

Sol. $|\bar{a} \times \bar{b}| = 15$

$$|(3\bar{a} + 2\bar{b}) \times (\bar{a} + 3\bar{b})| = |9(\bar{a} + \bar{b}) \times 2(\bar{b} + \bar{a})|$$

$$= |7(\bar{a} \times \bar{b})| = 7 \times 15 = 105$$