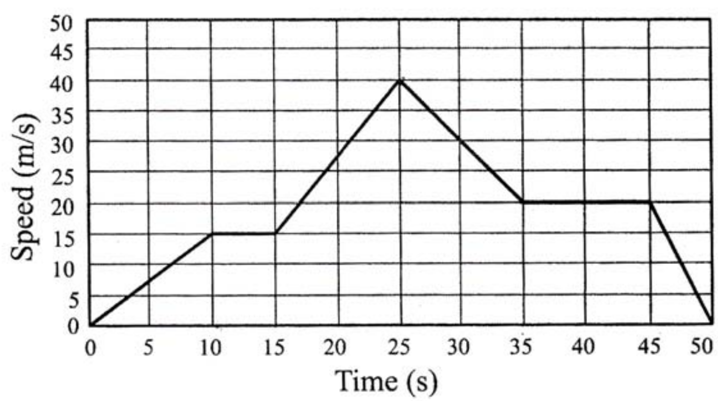
1. A person observes that the full length of a train subtends an angle of 15 degrees. If the distance between the train and the person is 3 km, the length of the train, calculated using parallax method, in meters is
(A) 45 (B) 45 π (C) 250 π (D) 250 π (E) 450
Ans : C

2. In a measurement, the random error
(A) Can be decreased by increasing the number of readings and averaging them
(B) Can be decreased by changing the person who takes the reading
(C) Can be decreased by using new instrument
(D) Can be decreased by using a different method in taking the reading
(E) Can never be decreased
Ans : A

3. In order to measure the period of a single pendulum using a stop clock, a student repeated the experiment for 10 times and noted down the time period for each experiment as 5.1, 5.0, 4.9, 4.9, 5.1, 5.0, 4.9, 5.1, 5.0, 4.9 s. The correct way of expressing the result for the period is
(A) 4.99 s (B) 5.0 s (C) 5.00s (D) 4.9 s (E) 5.1 s
Ans :D

4. The following figure gives the movement of an object. Select the correct statement from the given choice



(A) The total distance travelled by the object is 975 m
(B) The maximum acceleration of the object is 2m/s^2
(C) The maximum declaration happend between 25th and 35th seconds
(D) The object was at rest between 10th and 15th seconds
(E) At 40th second, the object was decelerating
Ans : A

5. Two object, P and Q, travelling in the same direction starts from rest. While the object P starts at time t = 0 and object Q starts later at t = 30 min. The object P has an acceleration of 40km/h^2. To catch P at a distance of 20 km, the acceleration of Q should be
(A) 40 km/h^2 (B) 80 km/h^2 (C) 100 km/h^2 (D) 120 km/h^2 (E) 160 km/h^2
Ans :E

6. A train of length L move with a constant speed V_t. A person at the back of the train fires a bullet at time t = 0 towards a target which is at a distance of D (at time t =0) from the front of the train (on the same direction of motion). Another person at the front of the train fires another bullet at time t = T towards the same target. Both bullets reach the target at the same time. Assuming the speed of the bullets, V_b, are same, the length of the train is

(A) $T\times (V_b + 2V_t)$ (B) $T\times (V_b + V_t)$ (C) $2\times T \times (V_b + 2V_t)$
(D) $2\times T \times (V_b - 2V_t)$ (D) $T \times (V_b - 2V_t)$

Ans :B

7. From the ground, a projectile is fired at an angle of 60 degrees to the horizontal with a speed of 20 m/s. Take acceleration due to gravity as 10 m/s^2. The horizontal range of the projectile is

(A) $10\sqrt{3}$ m (B) 20 m (C) $20\sqrt{3}$ m (D) $40\sqrt{3}$ m (E) $400\sqrt{3}$ m

Ans :C

8. A person from a truck, moving with a constant speed of 60 km/h, throws a ball upwards with a speed of 60 km/h. Neglecting the effect of rotation of Earth choose the correct answer from the given choice

(A) The person cannot catch the ball when it comes down since the truck is moving
(B) The person can catch the ball when it comes down, if the truck is stopped immediately after throwing the ball
(C) The person can catch the ball when it comes down, if the truck moves with speed less than 60 km/h but does not stop
(D) The person can catch the ball when it comes down, if the truck moves with speed more than 60km/h
(E) The person can catch the ball when it comes down, if the truck continues to move with a constant speed of 60 km/h

Ans :E

9. A body of mass 2m moving with velocity v makes a head on elastic collision with another body of mass m which is initially at rest. Loss of kinetic energy of the colliding body) (mass 2m) is

smooth surface is give as $x = 2t^2$. The work done in the first one second by the external force is

(A) 1 J (B) 2 J (C) 4 J (D) 8 J (E) 16 J

Ans : D

11. A massless spring of length *l* and spring constant *k* is placed vertically on a table. A all of mass m is just kept on top of the spring. The maximum velocity of the ball is

(A) $g\sqrt{\frac{m}{k}}$ (B) $g\sqrt{\frac{2m}{k}}$ (C) $2g\sqrt{\frac{m}{k}}$ (D) $\frac{g}{2}\sqrt{\frac{m}{k}}$ (E) $g\sqrt{\frac{m}{2k}}$

Ans : A

12. Under the action of a constant force, a particle is experiencing a constant acceleration. The power is

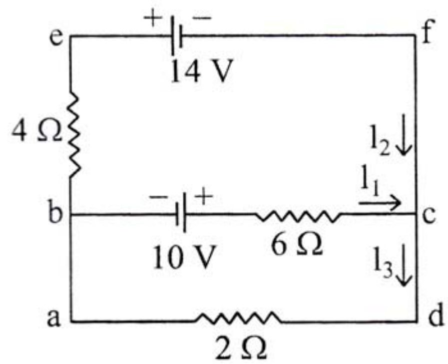
(A) Zero (B) Positive constant (C) Negative constant
(D) Increasing uniformly with time (E) Decreasing uniformly with time

Ans :D

13. A copper wire with a cross-section area of 2×10^{-6} m^2 has a free electron density equal to 5×10^{22} /cm^3. If this wire carries a current of 16A, the drift velocity of the electron is
(A) 1 m/s (B) 0.1 m/s (C) 0.01 m/s
(D) 0.001 m/s (E) 0.0001 m/s
Ans :D

14. The resistance of the tungsten wire in the light bulb, which is rated at 120V/75 W and powred by a 120 V direct-current supply, is
(A) 0.37 Ω (B) 1.2 Ω (C) 2.66 Ω (D) 192 Ω (D) 9×10^3 Ω
Ans :D

15. The value of the currents I_1, I_2, and I_3 flowing through the circuit given below is



(A) $I_1 = -3A, I_2 = 2A, I_3 = -1A$ (B) $I_1 = 2A, I_2 = -3A, I_3 = -1A$
(C) $I_1 = 3A, I_2 = -1A, I_3 = -2A$ (D) $I_1 = 1A, I_2 = -3A, I_3 = -2A$
(E)) $I_1 = 2A, I_2 = -1 A, I_3 = -3A$
Ans :B

16. A silver wire has temperature coefficient of resistivity 4×10^{-3}/^oC and its resistance at 20^{o}C is $10\,\Omega$. Neglecting any change in dimensions due to the change in temperature, its resistance at 40^{o}C is
(A)0.8 Ω (B) 1.8 Ω (C) 9.2 Ω (D) 10.8 Ω (E) 11.6 Ω
Ans :D

17. A change Q placed at the center of a metallic spherical shell with inner and outer radii R_1 and R_2 respectively. The normal component of the electric field at any point on the Gaussian surface with radius between R_1 and R_2 will be
(A) Zero (B) $\frac{Q}{4\pi R_1^2}$ (C) $\frac{Q}{4\pi R_2^2}$
(D) $\frac{Q}{4\pi (R_1 - R_2)^2}$ (E) $\frac{Q}{4\pi (R_2 - R_1)^2}$
Ans : A

18. A sphere of radius R has a uniform volume charge density, ρ. The magnitude of electric filed at a distance r from the centre of the sphere, where r > R, is
(A) $\frac{\rho}{4\pi\varepsilon_0 r^2}$ (B) $\frac{\rho R^2}{\varepsilon_0 r^2}$ (C) $\frac{\rho R^3}{\varepsilon_0 r^2}$ (D) $\frac{\rho R^3}{3\varepsilon_0 r^2}$ (E) $\frac{\rho R^2}{4\varepsilon_0 r^2}$
Ans :D

19. Five equal point charges with charge Q = 10 nC are located at x = 2, 4, 5, 10 and 20 m. If $\varepsilon_0 = [10^{-9}/36\pi]$ F/m, then the potential at the origin (x=0) is
(A) 9.9 V (B) 11.1V (C) 90 V (D) 99 V (E) 111 V
Ans :D

20. Two infinitely long parallel plates of equal areas, $6 cm^2$, are separated by a distance of 1 cm. While one of the plates has a charge of + 10 nC and the other has - 10nC. The magnitude of the electric field between the plates, if $\varepsilon_0 = \dfrac{10^{-9}}{36\pi}$ F/m is
(A) 0.6π kV/m (B) 6π kV/m (C)600π kV/m
(D) 60π V/m (E)6π V/m
Ans :C

21. A proton moves with a speed of 5.0×10^6 m/s along the x-axis. It enters a region where there is a magnetic field of magnitude 2.0 Tesla directed at an angle of 30^o to the x-axis and lying in the *xy* plane. The magnitude of the magnetic force on the proton is
(A) 0.8×10^{-13} N (B) 1.6×10^{-13} N (C) 8.0×10^{-13} N
(D) 8.0×10^{-13} N (E) 16×10^{-13} N
Ans :D

22. A long straight wire of radius R carries a steady current, I_0, uniformly distributed throughout the cross-section of the wire. The magnetic field at a radial distance *r* from the centre of the wire, in the region r> R, is
(A) $\dfrac{\mu_0 I_0}{2\pi r}$ (B) $\dfrac{\mu_0 I_0}{2\pi R}$ (C) $\dfrac{\mu_0 I_0 R^2}{2\pi r}$ (D) $\dfrac{\mu_0 I_0 r^2}{2\pi R}$ (E) $\dfrac{\mu_0 I_0 r^2}{2\pi R^2}$
Ans : A

23. If the cyclotron oscillator frequency is 16 MHz, then what should be the operating magnetic field for accelerating the proton of mass 1.6710^{-27} kg?
(A)0.334π T (B) 3.34π T (C) 33.4π T
(D)334π T (E)3340π T
Ans : A

24. The speed of light is vacuum is equal to
(A) $\mu_0\varepsilon_0$ (B) $\mu_0^2\varepsilon_0^2$ (C) $\sqrt{\mu_0\varepsilon_0}$ (D) $\dfrac{1}{\mu_0\varepsilon_0}$ (E) $\dfrac{1}{\sqrt{\mu_0\varepsilon_0}}$
Ans :E

25. A comet orbits around Sun in an elliptical orbit. Which of the following quantities remains constant during the course of its motion?
(A) Linear velocity (B) Angular velocity (C) Angular momentum
(C) Kinetic energy (E) Potential energy
Ans :C

26. Consider a satellite moving in a circular orbit around Earth. If K and V denote its kinetic energy and potential energy respectively then (Choose the convention where V = 0 as $r \to \infty$)
(A) K = V (b) K = 2V (C) V = 2K (D) K = – 2V (D) V = – 2 K
Ans :E

27. Assuming the mass of Earth to be ten times the mass of Mars and its radius to be twice the radius of Mars and the acceleration due to gravity on the surface of Earth to be 10 m/s^2, the acceleration due to gravity on the surface of Mars is given by
(A) 0.2 m/s^2 (B) 0.4 m./^{2} (C) 2 m/s^2 (D) 4 m/s^2 (E) 5 m/s^2
Ans : D

28. The semi-major axis of the orbit of Saturn is approximately nine times that of Earth. The time period of revolution of Saturn is approximately equal to
(A) 81 years (B) 27 years (C) 729 years
(D) $\sqrt[3]{81}$ years (E) 9 years
Ans :B

29. A particle of mass 3 kg, attached to a spring with force constant 48 N/m execute simple harmonic motion on a frictionless horizontal surface. The time period of oscillation of the particle, in seconds, is
(A) π /4 (B) π /2 (C)2 π (D)8 π (E) π /8
Ans :B

30. The position and velocity of a particle executing simple harmonic motion at t = 0 are given by 3 cm and 8 cm/s respectively. If the angular frequency of the particle is 2 rad/s then the amplitude of oscillation, in centimeters, is
(A) 3 (B) 4 (C) 5 (D) 6 (E) 8
Ans :C

31. A simple harmonic motion is represented by $x(t)=\sin^2 \omega t - 2\cos^2 \omega t$. The angular frequency of oscillation is given by
(A) ω (B) 2 ω (C) 4 ω (D) ω /2 (E) ω /4
Ans :B

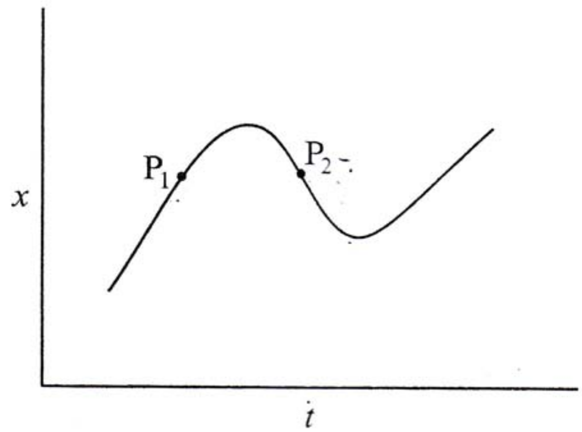
32. A transverse wave is propagating on a stretched string shoes mass per unit length is 32 g/m. The tension on the string is 80 N. The speed of the wave in the string is
(A) 5/2 m/s (B) $\sqrt{5/2}$ m/s (C) 2/5 m/s (D) $\sqrt{2/5}$ m/s (E)50 m/s
Ans :E

33. Consider the propagating of sound (with velocity 330 m/s) in a pipe of length 1.5 m with one end closed and the other open. The frequency associated with the fundamental mode is
(A) 11 Hz (B) 55Hz (C) 110Hz (D) 165 Hz (E) 275 Hz
Ans :B

34. A standing wave propagating with velocity 300 m/s in an open pipe of length 4 m has four nodes. The frequency of the wave is
(A) 75 Hz (B) 100 Hz (C) 150 Hz (D) 300 Hz (E) 600 Hz
Ans : C

35 Consider a vehicle emitting sound wave of frequency 700 Hz moving towards an observer at a speed 22 m/s. Assuming the observer as well as the medium to be at rest ad velocity of sound in the medium to be 330 m/s, the frequency of sound as measured by the observeris
(A) 2525/4 Hz (B) 1960/3 Hz (C) 2240/3 Hz
(D) 750 Hz (E) 5625/7 Hz
Ans :D

36. The x-t plot shown in the figure below describes the motion of the particle, along x-axis, between two positions A and B. The particle passes through two intermediate points P_1 and P_2 as shown in the figure



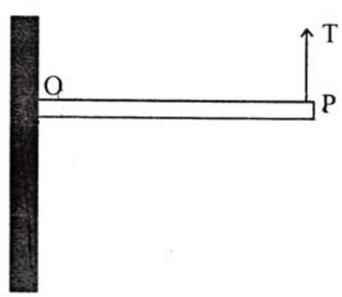
(A) The instantaneous velocity is positive at P_1 and negative at P_2
(B) The instantaneous velocity is negative at both P_1 and P_2
(C) The instantaneous velocity is negative at P_1 and positive at P_2
(D) The instantaneous velocity is positive at both P_1 and P_2
(E) The instantaneous velocity is always positive
Ans : A

37. A ball falls from a table top with initial horizontal speed V_0. In the absence of air resitance, which of the following statement is correct
(A) The vertical component of the acceleration changes with time
(B) The horizontal component of the velocity does not change with time
(C) The horizontal component of the acceleration is non zero and finite
(D) The time taken by the ball to touch the ground depends on V_0.
(E) The vertical component of the acceleration varies with time
Ans : B

38. A man of mass 60 kg climbed down using an elevator. The elevator had an acceleration 4 ms^{-2}. If the acceleration due to gravity is 10 ms^{-2}, the main apparent weight on his way down is
(A) 60 N (B) 240 N (C) 360 N (D) 840 N (D) 3600N
Ans :C

39. A uniform rod of length of 1 m and mass of 2 kg is attached to a side support at O as shown in the figure. The rod is at equilibrium due to upward force T acting at P. Assume the acceleration due to gravity as 10 m/s^2. The value of T is

(A) 0
(B) 2N
(C) 5 N
(C) 5 N
(D) 10 N
(E) 20 N
Ans :D



40. A capillary tube of radius 0.5 mm is immersed in a breaker of mercury. The level inside the tube is 0.8 cm below the resonance and angle of contact is 120^{o}. What is the surface tension of mercury if the mass density of mercury is $\rho = 13.6\times10^{3}kgm^{-3}$ and acceleration due to gravity is $g = 10\ m/s^{2}$?
(A) 0.225N/m (B) 0.544 N/m (C) 0.285 N/m
(D) 0.375 N/m (E) 0.425 N/m
Ans :B

41. Which of the following statements related to stress – strain relation is correct
(A) Stress is linearly proportional to strain irrespective of the magnitude of the strain
(B) Stress is linearly proportional to strain above the yield point
(C) Stress is linearly proportional to strain for stress much smaller than at the yield point
(D) Stress – strain curve is same for all materials
(E) Stress is inversely proportional to strain
Ans : C

42. The lower edge of a square slab of side 50 cm and thickness 20 cm is rigidly fixed to the base of a table. A tangential force of 30 N is applied to the slab. If the shear moduli of the material is $4\times10^{10}\,N/m^{2}$, then displacement of the upper edge, in meters, is
(A) 4×10^{-12} (B) 4×10^{-10} (C) 6×10^{-10} (D) 6×10^{-12} (E) 8×10^{-10}
Ans : C

43. Initially a beaker had 100g of water at temperature $90^{o}C$. Later another 600g of water at temperature $20^{o}C$ was poured into the beaker. The temperature, T, of the water after mixing is
(A) $20^{o}C$ (B) $30^{o}C$ (C) $45^{o}C$ (D) $55^{o}C$ (E) $90^{o}C$
Ans : B

44. Match the following
I) Isothermal process 1) $\Delta Q = 0$
II) Isobaric process 2) $\Delta V = 0$
III) Isochoric process 3) $\Delta P = 0$
IV) Adiabatic process 4) $\Delta T = 0$
(A) I – 4, II – 3, III – 2, IV – 1 (B) I – 3, II – 2, III – 1, IV – 4
(C) I – 1, II – 2, III – 3, IV – 4 (D) I – 4, II – 2, III – 3, IV – 1
(E) I – 1, II – 4, III – 2, IV – 3
Ans : A

45. For an ideal gas, the specific heat at constant pressure C_p is greater than the specific heat at constant volume C_v. This is because
(A) There is a finite work done by the gas on its environment when its temperature is increased while the pressure remains constant
(B) There is a finite work done by the gas on its environment when its pressure is increased while the volume remains constant
(C) There is a finite work done by the gas on its environment when its pressure is increased while the temperature remains constant
(D) The pressure of the gas remains constant when its temperature remains constant
(E) The internal energy of the gas at constant pressure is more than at constant volume
Ans : A

46. Which of the following statements is correct?
(A) Light waves are transverse but sound waves and waves on strings are longitudinal
(B) Sound waves and waves on a string are transverse but light waves are longitudinal
(C) Light waves and waves on a string are transverse but sound waves are longitudinal
(D) Light waves and waves are transverse but waves on strings are longitudinal
(E) Light waves, sound waves and waves on a string are all longitudinal
Ans : C

47. In Young's double slit experiment, if the separation between the slits is halved, and the distance between the slits and the screen is doubled, then the fringe width compared to the unchanged one will be
(A) Unchanged (B) Halved (C) Doubled
(D) Quadrupled (D) Fringes will disappear
Ans : D

48. The phase velocity of a wave described by the equation $\psi = \psi_0 \sin(kx + \omega t + \pi/2)$ is
(A) x/t (B) ψ_0/ω (C) ω/k (D) $\pi/2k$ (E) ψ_0
Ans : C

49. The direction of propagation of electromagnetic wave is along
(A) Electric field vector, $\vec{E}$ (B) Magnetic field vector, $\vec{B}$
(C) $\vec{E}.\vec{B}$ (D) $\vec{E}\times\vec{B}$ (E) $\vec{B}\times\vec{E}$
Ans : D

50. Assume that a radio station is about 200 km away from your location and the station operates at 972 kHz. How long does it take for an electromagnetic signal to travel from the station to you and how many wave crests doe it send out per second
(A) 666 μs and 9.72×10^5 crests per second
(B) 666 μs and 972×10^5 crests per second
(C) 555 μs and 97.2×10^7 crests per second
(D) 555 μs and 0.972×10^5 crests per second
(E) 444 μs and 9×10^6 crests per second
Ans : A

51. What wavelength must electromagnetic radiation have if a photon in the beam has the same momentum as an electron moving with a speed $1.1\times10^5\,m/s$ (Planck's constant = $6.6\times10^{-34}\,Js$, rest mass of electron = $9\times10^{-31}\,kg$?
(A) 2/3 nm (B) 20/3 nm (C) 4/3 nm (D) 40/3 nm (E) 3/20 nm
Ans : B

52. The electron field portion of an electromagnetic wave is given by (all variables in SI units) $E = 10^{-4}\sin(6\times10^5 t - 0.01x)$. The frequency (f) and the speed (v) of electromagnetic wave are
(A) f = $30/\pi$ kHz and $v = 1.5\times10^7\,m/s$ (B) f = $90/\pi$ kHz and $v = 6.0\times10^7\,m/s$
(C) f = $300/\pi$ kHz and $v = 6.0\times10^7\,m/s$ (D) f = $600/\pi$ kHz and $v = 7.5\times10^7\,m/s$
(E) f = $900/\pi$ kHz and $v = 8.0\times10^7\,m/s$
Ans : C

53. Huygens' wave theory of light cannot explain
(A) Diffraction phenomena (B) Interference phenomena (C) Photoelectric effect
(D) Polarization of light (E) Propagation of light
Ans : C

54. An electron, a neutron and an alpha particle have same kinetic energy and their de – Broglie wavelengths are $\lambda e, \lambda n$ and $\lambda\alpha$ respectively. Which statement is correct about their de – Broglie wavelengths?
(A) $\lambda e > \lambda n > \lambda\alpha$ (B) $\lambda e < \lambda n > \lambda\alpha$ (C) $\lambda e < \lambda n < \lambda\alpha$
(D) $\lambda e > \lambda n < \lambda\alpha$ (E) $\lambda e = \lambda n < \lambda\alpha$
Ans : A

55. It takes 4.6 eV to remove one of the least tightly bound electrons from a metal surface. When monochromatic photons strike the metal surface, electrons having kinetic energy from zero to 2.2 eV are ejected. What is the energy of the incident photons?
(A) 2.4 eV (B) 2.2 eV (C) 6.8 eV (D) 4.6 eV (E) 5.8 eV
Ans : C

56. If copper and silicon pieces are heated, the resistance of
(A) each will increase (B) each will decrease
(C) copper will increase and silicon will decrease
(D) copper will decrease and silicon will increase
(E) both does not change
Ans : C

57. In an insulator, band gap of the order of
(A) 0.1 eV (B) 1 eV (C) 5 eV (D) 100 eV (E) 1 MeV
Ans : C

58. For a P – N junction diode
(A) Forward current is in mA and reverse current is in μA
(B) Forward current is in μA and reverse current is in mA
(C) Both forward and reverse currents are in μA
(D) Both forward and reverse currents are in mA
(E) No current flows in any direction
Ans : A

59. For a Zener diode
(A) both p and n regions are heavily doped
(B) p region is heavily doped but n region is lightly doped
(C) n region is heavily doped but p region is lightly doped
(D) both p and n regions are lightly doped
(E) depletion region is very thick
Ans : B

60. Speech signal is in the range of
(A) 3700 to 7000 $\overset{o}{A}$ wavelength (B) 20 Hz to 20 kHz frequency (C) 300 to 3100 Hz frequency
(D) 540 to 1600 kHz frequency (E) 88 to 108 MHz frequency
Ans : C

61. Wavelength of the wave with 30 MHz frequency is
(A) 1 cm (B) 10 cm (C) 100 cm (D) 1000 cm (E) 10000 cm
Ans : D

62. To transmit a signal of frequency, ω_m, with a carrier frequency, ω_c, in AM transmission, the bandwidth of the filter and amplifier is
(A) ω_m (B) $2\omega_m$ (C) ω_c (D) $\omega_c - \omega_m$ (E) $\omega_c + \omega_m$
Ans : B

63. If a magnet is dropped through a vertical hollow copper tube then
(A) the time taken to reach the ground is longer than the time taken if the tube was made out of plastic
(B) the magnet will get attracted and stick to the copper tube
(C) the time taken to reach the ground is longer than the time taken if the tube was made out of stainless steel
(D) the time taken to reach the ground does not depend on the radius of the copper tube
(E) the magnet will be repelled away by the tube
Ans : D

64. Consider a circular wire loop of radius R spinning about a diametrical chord which is perpendicular to a uniform magnetic field $(\vec{B} = B_0\hat{k})$
(A) The magnitude of the induced EMF in the loop is maximum when the plane of the loop is perpendicular to $\vec{B}$
(B) Flux through the loop is minimum when the plane of the loop is perpendicular to $\vec{B}$
(C) The direction of induced current remains same during the spinning motion of the loop
(D) EMF induced will be the same for a larger radius of the loop in the same field
(E) No EMF will be induced since magnetic field is constant
Ans : A

65. An electric motor when loaded has an effective resistance of 30Ω and an inductive reactance of 40Ω. If the motor is powered by a source with maximum voltage of 420 V, the maximum current is
(A) 6A (B) 8.4 A (C) 10 A (D) 12 A (E) 13A
Ans : B

66. Which of the following particle when bombards on ^{65}Cu will turn into ^{66}Cu
(A) Proton (B) Neutron (C) Electron (D) Alpha particle (E) Deutron
Ans : B

67. CO^- ion moving with kinetic energy of 20 keV dissociates into O^- and C which move along the parent ion direction. Assuming no energy is released during dissociation, the kinetic energy of the daughters $(K.E)_{O^-}$ and $(K.E)_C$ are related as
(A) $(K.E)_{O^-} = (K.E)_C$ (B) $(K.E)_{O^-} / (K.E)_C = 16/12$
(C) $(K.E)_{O^-} / (K.E)_C = 12/16$ (D) $(K.E)_{O^-} / (K.E)_C = 16/28$
(E) $(K.E)_{O^-} / (K.E)_C = 28/16$
Ans : C

68. If the rms value of sinusoidal input to a full wave rectifier is $V_0/\sqrt{2}$ then the rms value of the rectifier's output is
(A) $V_0/\sqrt{2}$ (B) $V_0^2/\sqrt{2}$ (C) $V_0^2/2$ (D) $\sqrt{2}V_0^2$ (E) $2V_0^2$
Ans : A

69. Eight grams of Cu^{66} undergoes radioactive decay and after 15 minutes only 1g remains. The half – life, in minutes, is then
(A) 15 ln (2)/ln (8) (B) 15 ln(8)/ln(2) (C) 15/8 (D) 8/15 (E) 15 ln(2)
Ans : A

70. For a light nuclei, which of the following relation between the atomic number (Z) and mass number (A) is valid
(A) A = Z/2 (B) Z = A (C) Z = A/2 (D) $Z = A^2$ (E) $A = Z^2$
Ans : C

71. A wheel rotating at 12 rev/s is brought to rest in 6s. The average angular deceleration in rad/s^2 of the wheel during this process is
(A) 4π (B) 4 (C) 72 (D) $1/\pi$ (E) π
Ans : A

72. A torque of 1 N.m is applied to a wheel which is at rest. After 2 seconds the angular momentum in kg. m^2/s is
(A) 0.5 (B) 1 (C) 2 (D) 4 (E) 3
Ans :C

73. Uncertainty principle is valid for
(A) Proton (B) Methane (C) Both (A) and (B)
(D) $1\mu m$ sized platinum particles (E) $1\mu m$ sized NaCl particles
Ans : A

74. The energy of an electron in the 3S orbital (excited state) of H – atom is
(A) – 1.5 eV (B) – 13.6 eV (C) – 3.4 eV (D) – 4.53 eV (E) 4.53 eV
Ans : A

75. Among the following, the molecule that will have the highest dipole movement is
(A) H_2 (B) HI (C) HBr (D) HCl (E) HF
Ans :E

76. Which of the following pair have identical bond order?
(A) CN^- and NO^+ (B) CN^- and O_2^- (C) CN^- and CN^+
(D) NO^+ and O_2^- (E) O_2^- and CN^+
Ans : A

77. A gas will approach ideal behavior at
(A) Low temperature and low pressure (B) Low temperature and high pressure
(C) High temperature and low pressure (D) High temperature and high pressure
(E) Low volume and high pressure
Ans :C

78. Pressure of ideal and real gases at 0K are
(A) > 0 and 0 (B) < 0 and 0 (C) 0 and 0
(D) > 0 and > 0 (E) 0 and > 0
Ans :E

79. For the process A (l, 0.05 atm, 32°C) $\rightarrow$ A(g, 0.05 atm, 32°C)
The correct set of themrodynamic parameters is
(A) $\Delta G = 0$ and $\Delta S = -ve$ (B) $\Delta G = 0$ and $\Delta S = +ve$
(C) $\Delta G = +ve$ and $\Delta S = 0$ (D) $\Delta G = -ve$ and $\Delta S = 0$ (E) $\Delta G = 0$ and $\Delta S = 0$
Ans :B

80. Mixing of N_2 and H_2 form an ideal gas mixture at room temperature in a container. For this process, which of the following statement is true?
(A) $\Delta H = 0, \Delta S_{surrounding} = 0, \Delta S_{system} = 0$ and $\Delta G = -ve$
(B) $\Delta H = 0, \Delta S_{surrounding} = 0, \Delta S_{system} > 0$ and $\Delta G = -ve$
(C) $\Delta H > 0, \Delta S_{surrounding} = 0, \Delta S_{system} > 0$ and $\Delta G = -ve$
(D) $\Delta H < 0, \Delta S_{surrounding} > 0, \Delta S_{system} < 0$ and $\Delta G = -ve$
(E) $\Delta H = 0, \Delta S_{surrounding} = 0, \Delta S_{system} < 0$ and $\Delta G = -ve$
Ans : D

81. Which of the following is not true about a catalyst?
(A) Mechanism of the reaction in presence and absence of catalyst could be different
(B) Enthalpy of the reaction does not change with catalysts
(C) Catalyst enhances both forward and backward reaction at equal rate
(D) Catalyst participates in the reaction, but not consumed in the process
(E) Use of catalyst cannot change the order of the reaction
Ans :E

82. In the In K vs. $\frac{1}{T}$ plot of a chemical process having $\Delta S^0 > 0$ and $\Delta H^0 < 0$ the slope is proportional to (where K is equilibrium constant)
(A) $-|\Delta H^0|$ (B) $|\Delta H^0|$ (C) ΔS^0 (D) $-\Delta S^0$ (E) ΔG^0
Ans :B

83. For the process
$\frac{3}{2}A \rightarrow B$, at 298 K, ΔG^0 is 163 kJ mol^{-1}. The composition of the reaction mixture is [B] = 1 and [A] = 10000. Predict the direction of the reaction and the relation between reaction quotient (Q) and the equilibrium constant (K)
(A) Forward direction because Q > K (B) Reverse direction because Q > K
(C) Forward direction because Q < K (D) Reverse direction because Q < K
(E) It is at equilibrium as Q = K
Ans : C

84. Solubility product (K_{sp}) of saturated $PbCl_2$ in water is 1.8×10^{-4} mol^3 dm^{-9}. What is the concentration of Pb^{2+} in the solution?
(A) $(0.45 \times 10^{-4})^{1/3}$ mol dm^{-3} (B) $(1.8 \times 10^{-4})^{1/3}$ mol dm^{-3} (C) $(0.9 \times 10^{-4})^{1/3}$ mol dm^{-3}
(D) $(2.0 \times 10^{-4})^{1/3}$ mol dm^{-3} (E) $(2.45 \times 10^{-4})^{1/3}$ mol dm^{-3}
Ans : A

85. The freezing point of equimolal aqueous solutions will be highest for
(A) $C_6H_5NH_3Cl$ (B) $AgNO_3$ (C) $Ca(NO_3)_2$
(D) $La(NO_3)_3$ (E) D-fructose
Ans :E

86. The molality of the 3M solution of methanol if the density of the solution is 0.9 g cm^{-3} is
(A) 3.73 (B) 3.0 (C) 3.33 (D) 3.1 (E) 3.2
Ans : A

87. Consider a fuel cell supplied with 1 mole of H_2 gas and 10 moles of O_2 gas. If fuel cell is operated at 96.5 mA current, how long will it deliver power?
(Assume 1 F = 96500 C/mole of electrons)
(A) 1×10^6 s (B) 0.5×10^6 s (C) 2×10^6 s (D) 4×10^6 s (E) 5×10^6 s
Ans :C

88. Consider the equilibrium obtained by electrically connecting zinc-amalgam (Zn(Hg) and HgO electrodes in mercury cell,
$An(Hg) + HgO(s) \rightleftharpoons ZnO(s) + Hg(l)$
Under this equilibrium, what is the relation between the potential of the Zn(Hg) and HgO electrodes measured against the standard hydrogen electrode?
(A) Zn(Hg) electrode potential is equal to HgO electrode potential
(B) Zn(Hg) electrode potential is more than HgO electrode potential
(C) HgO electrode potential is more than Zn(Hg) electrode
(D) Cell voltage at above said equilibrium is 1.35 V
(E) Both (C) and (D)
Ans : A

89. 10 g of $MgCO_3$ decomposes on heating to 0.1 mole CO_2 and 4 g MgO. The percent purity of $MgCO_3$ is
(A) 24 % (B) 44% (C) 54% (D) 74% (E) 84%
Ans :E

90. The compound $Na_2CO_3 \bullet x\, H_2O$ has 50% H_2O by mass. The value of "x" is
(A) 4 (B) 5 (C) 6 (D) 7 (E) 8
Ans :C

91. Hybridisation of carbon in CH_3^-
(A) sp^2 (B) sp^3 (C) sp^3d (D) sp^3d^2 (E) sp^2d^3
Ans :B

*92. The common features among CO, CN^- and NO_2^+ are
(A) Bond order three and isoelectronic (B) Bond order three and weak field ligands
(C) Bond order two and π -acceptors (D) Bond order three and π -donors
(E) Isoelectronic and strong field ligands
Ans : A

93. Which of the following is covalent?
(A) NaCl (B) KCl (C) $BeCl_2$ (D) $MgCl_2$ (E) $CaCl_2$
Ans :C

94. One mole of an unknown compound was treated with excess water and resulted in the evolution of two moles of a readily combustible gas. The resulting solution was treated with CO_2 and resulted in the formation of white turbidity. The unknown compound is
(A) Ca (B) CaH_2 (C) $Ca(OH)_2$ (D) $Ca(NO_3)_2$ (E) $CaSO_4$
Ans :B

*95. When potassium is reacted with water, which compound(s) is (are) formed preferentially?
(A) K_2O (B) KO_2 (C) Both K_2O and KO_2 (D) K_2O_2 (E) K_2O_3
Ans :B

96. Purification of aluminium by electrolytic refining is called
(A) Hall's process (B) Froth flotation process (C) Bayer's process
(D) Hoop's process (E) Serpeck's process
Ans :D

97. Select the most appropriate statement In BF_3
(A) All the bonds are completely ionic
(B) The B-F bond is partially ionic
(C) B-F bond has partial double bond character
(D) Bond energy and bond length data indicates single bond character of the B-F bond
(E) All the bonds are covalent
Ans :E

98. The inert gas found most abundant in the atmosphere is
(A) He (B) Ne (C) Ar (D) Kr (E) Xe
Ans : C

99. When MnO_2 is fused with KOH and KNO_2, a coloured compound is formed. Choose the right compound with the appropriate colour
(A) K_2MnO_4, green (B) $KMnO_4$, purple (C) Mn_2O_3, brown
(D) Mn_3O_4, black (E) MnO_2, black
Ans : A

100. Identify the case(s) where there is change in oxidation number
(A) Acidified solution of CrO_4^{2-}
(B) SO_2 gas bubbled through an acidic solution $Cr_2O_7^{2-}$
(C) Alkaline solution of $Cr_2O_7^{2-}$ (D) Ammoniacal solution of CrO_4^{2-}
(E) Aqueous solution of CrO_2Cl_2 in NaOH
Ans :B

101. Water gas is produced by
(A) Passing steam over red hot coke (B) Passing steam and air over red hot coke
(C) Burning coke in excess air (D) Burning coke in limited supply of air
(E) Both (A) and (B)
Ans : A

102. The volume of oxygen liberated at STP from 15 ml of 20 volume H_2O_2 is
(A) 100 mL (B) 150 mL (C) 200 mL (D) 250 mL (E) 300 mL
Ans :E

103. Corundum is __________ mineral of aluminium.
(A) Silicate (B) Oxide (C) Double salt (D) Sulphate (E) Nitrate
Ans :B

104. The solution which does not produce precipitate when treated with aqueous K_2CO_3 is
(A) $BaCL_2$ (B) $CaBr_2$ (C) $MgCl_2$ (D) Na_2SO_4 (E) $Pb(N)_3)_2$
Ans :D

105. If the boiling point difference between the two liquids is not much, the ________ method is used to separate them
(A) Simple distillation
(B) Distillation under reduced pressure
(C) Steam distillation
(D) Fractional distillation
(E) Differential extraction
Ans :D

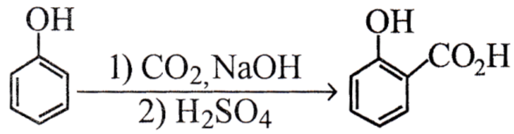
106. Lassaigne's test (with silver nitrate) is commonly used to detect halogens such as chlorine, bromine and iodine but not useful to detect fluorin because the product AgF formed is
(A) Volatile (B) Reactive (C) Explosive (D) Soluble in water
(E) A liquid
Ans :D

107. Protein is a polymer made of
(A) Carbohydrates (B) Aminoacids (C) Nucleic acids
(D) Carboxylic acids (E) Polycyclic aromatics
Ans :B

108. The letter 'D' in D-carbohydrates represents
(A) Dextrorotation (B) Direct synthesis (C) Configuration
(D) Mutarotation (E) Optical activity
Ans :C

109. Phenol is a highly corrosive substance, but its 0.2 per cent solution is used as
(A) Antibiotic (B) Antiseptic (C) Disinfectant
(D) Antihistamine (E) Antacid
Ans :B

110. Name of the following reaction is



(A) Reimer-Tiemann (B) Kolbe-Schmitt (C) Cannizzaro
(D) Gattermann (E) Gattermann-Koch
Ans :B

111. X and Y in the below reaction are ---------- and ------------- respectively

$$C_6H_5-CO_2H + X \xrightarrow{heat} C_6H_5-COCl \xrightarrow[quinoline]{H_2,Pd/BaSO_4} Y$$

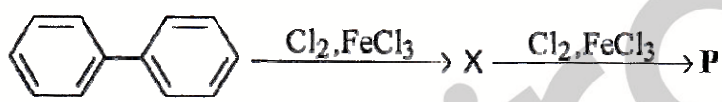
(A) $SOCl_2$ and C_6H_5CHO (B) $(COCl)_2$ and $C_6H_5CH_3$
(C) $SOCl_2$ and $C_6H_5CH_3$ (D) $(COCl)_2$ and $C_6H_5CH_2$ OH
(D) $SOCl_2$ and $C_6H_5CH_2Cl$
Ans : A

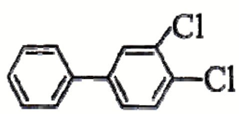
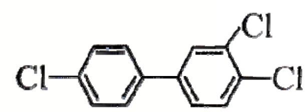
112. The reaction of propene with HBr in presence of peroxide proceeds through the intermediate

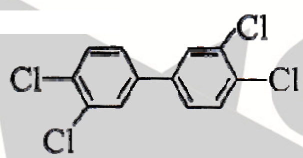
(A) $H_3C-\underset{\bullet}{C}H-CH_3$ (B) $H_3C-\underset{\bullet}{C}H-CH_2Br$ (C) $H_3C-\overset{Br}{\overset{|}{CH}}-\dot{C}H_2$

(D) $H_3C-CH_2-\dot{C}H_2$ (E) None of the above
Ans :B

113. The major product P formed in the following reaction is



(A)  (B)  (C) 

(D)  (E) 

Ans :B

114. The correct increasing order of the acid strength of acids, butyric acid (I), 2 – chlorobutyric acid (II), 3 – chlorobutyric acid (III) and 2, 2-dichlorobutyric acid (IV) is
(A) I < II < III < IV (B) III < II < IV < I (C) I < III < II < IV
(D) III < I < II < IV (E) IV < III < II < I
Ans :C

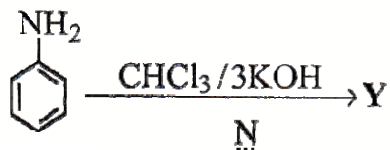
115. Cycloheptatrienyl cation is
(A) Non-benzenoid and non-aromatic (B) Non-benzenoid and aromatic
(C) Benzenoid and non-aromatic (D) Benzenoid and aromatic
(E) Non-benzenoid and anti-aromatic
Ans :B

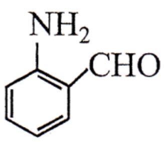
116. The correct order of increasing reactivity of the following alkyl halides, $CH_3CH_2CH(Br)CH_3$ (I), $CH_3CH_2CH_2CH_2Br$ (II), $(CH_3)_2CClCH_2CH_3$ (III) and $CH_3CH_2CH_2Cl$ (IV) towards S_N2 displacement is
(A) I < II < III < IV (B) III < I < IV < II (C) III < I < II < IV
(D) II < IV < I < III (E) I < III < II < IV
Ans : B

117. The strongest base among the following is
(A) Amide ion (B) Hydroxide ion (C) Trimethylamine
(D) Ammonia (D) Aniline
Ans : A

118. The condensation reaction between one equivalent of acetone and two equivalents of benzaldehyde in presence of dilute alkali leads to the formation of
(A) Benzalacetophenone (B) Benzylideneacetone (C) Dibenzylideneacetone
(D) Benzoic acid and acetic acid (E) Only benzoic acid
Ans :C

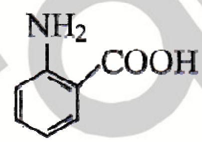
119. The product Y for the below reaction is

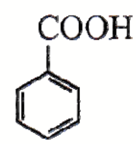


(A) 

(B) 

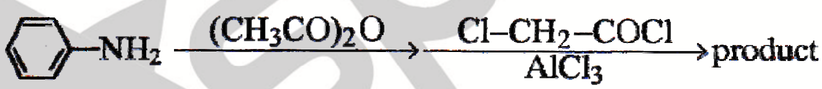
(C) 

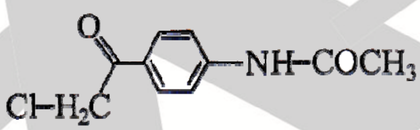
(D) 

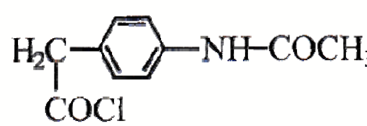
(E) 

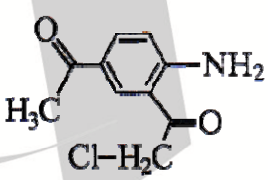
Ans :C

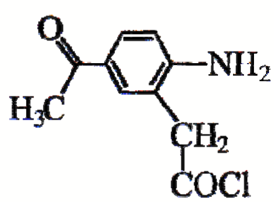
120. The product formed in the following reaction is

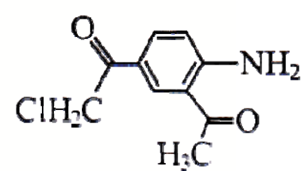


(A) 

(B) 

(C) 

(D) 

(E) 

Ans : A