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Previous Year Paper

Physics - 2017

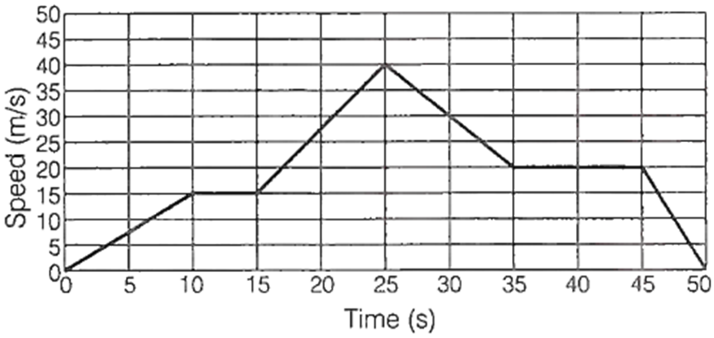
Multiple Choice Questions

1. A person observes that the full length of a train subtends an angle of 15°. 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. 75 π

   Answer
2. In a measurement, 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

   Answer
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. 5.00 s
   - D. 4.9 s

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



   - A. The total distance travelled by the object is 975 m

B. The maximum acceleration of the object is $2 m/s^2$

C. The maximum deceleration happend between 25th and 85th seconds

D. The object was at rest between 10th and 15th seconds

Answer

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 $40 km/h^2$. 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. $160 km/h^2$

   D. $120 km/h^2$

Answer

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. $T \times (V_b \times 2V_t)$

   B. $T \times (V_b + V_t)$

   C. 2VbDVb + Vt + T Vb - Vt

   D. $T \times (V_b - 2V_t)$

Answer

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. 103 m

   B. 20 m

   C. 203

   D. 403 m

Answer

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 Earth and 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 continues to move with a constant speed of 60 km/h

D. The person can catch the ball when it comes down, if the truck moves with speed more than 60 km/h

Answer

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

A. 1/9 of its initial kinetic energy

B. 1/6 of its initial kinetic energy

C. 8/9 of its initial kinetic energy

D. 1/2 of its initial kinetic energy

Answer

10. Displacement x (in meters), of body of mass 1 kg as a function of time t, on a horizontal smooth surface is given 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

Answer

11. 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

Answer

12. A comet orbits around the 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

D. Kinetic energy

Answer

13. 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

Answer

14. Assuming the mass of Earth to be ten times the mass of Mars, its radius to be twice the radius of

Mars and the acceleration due to gravity on the surface of Earth is 10 m/s^2. Then the acceleration due to gravity on the surface of Mars is given by

A. 0.2 m/s^2

B. 0.4 m/s^2

C. 2 m/s^2

D. 4 m/s^2

Answer

15. 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

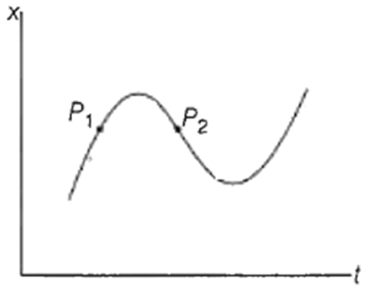
B. 27 years

C. 729 years

D. 813 years

Answer

16. 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 as 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

Answer

17. A ball falls from a table top with initial horizontal speed V_0. In the absence of air resistance,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 to the acceleration is non zero and finite

D. The time taken by the ball to touch the ground depends on V_0

Answer

18. 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 man's apparent weight on his way down is

A. 60 N

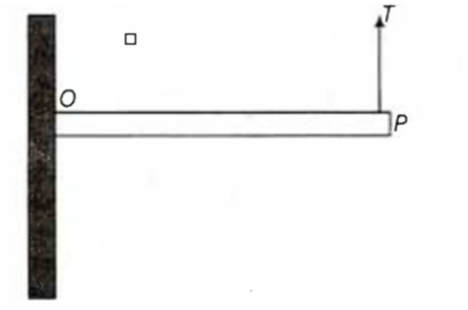
B. 240 N

C. 360 N

D. 840 N

Answer

19. A uniform rod of length of 1 m arid 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. 2 N

C. 5 N

D. 10 N

Answer

20. 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. $(K.E)_{O^-} / (K.E)_C = 16/28$

Answer

21. A wheel rotating at 12 rev/sis brought to rest in 6 s. The average angular deceleration in rad/s^2 of the wheel during this process is

A. −4 π

B. 4

C. 72

D. 1/π

Answer

22. A torque of 1 N-m is applied to a wheel which is at rest. After 2 second the angular momentum in

kg-m^2/s is

A. 0.5

B. 1

C. 2

D. 4

Answer

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

A. gmk

B. g2mk

C. 2gmk

D. g2 mk

Answer

24. 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. 2π

D. 8π

Answer

25. The position and velocity of a particle executing simple harmonic motion at t = 0 are given by 3 cm/s 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

Answer

26. 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. 2ω

C. 4ω

D. ω/2

Answer

27. A transverse wave in propagating on a stretched string of mass per unit length 32 g/m. The tension on the string is 80 N. The speed of the wave over the string is

A. 5/2 m/s

B. 5/2 m/s
C. 50 m/s
D. 2/5 m/s

Answer

28. Consider the propagating 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. 55 Hz
    C. 110 Hz
    D. 165 Hz

Answer

29. 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

Answer

30. Consider the 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 and velocity of sound in the medium to be 330 m/s, the frequency of sound as measured by the observer is
    A. 2525/4 Hz
    B. 1960/3 Hz
    C. 2240/3 Hz
    D. 750 Hz

Answer

31. A capillary tube of radius 0.5 mm is immersed in a beaker of mercury. The level inside the tube is 0.8 cm below the level in beaker and angle of contact is 120°. What is the surface tension of mercury, if the mass density of mercury is $\rho = 13.6 \times 10^{3}$ kgm^{-3} and acceleration due to gravity is $g = 10$ m/s^{2} ?
    A. 0.225 N/m
    B. 0.544 N/m
    C. 0.285 N/m
    D. 0.375 N/m

Answer

32. Which of the following statement 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
    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

Answer

33. 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 x 10^{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}

Answer

34. Initially a beaker has 100 g of water at temperature 90°C. Later another 600 g of water at temperature 20°C was poured into the beaker. The temperature, T of the water after mixing is

A. 20°C

B. 30°C

C. 45°C

D. 55°C

Answer

35. 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

Answer

36. 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

Answer

37. Which of the following statement is correct ?
    - A. Light waves are transverse but sound waves are waves on strings are longitudinal
    - B. Sound waves and waves on a string and 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 sound waves are transverse but waves on string are longitudinal

Answer

38. The phase velocity of a wave described by the equations ψ = ψ0 sin kx + ωt + π/2 is
    - A. x/t
    - B. ψ_0/ω
    - C. ω/k
    - D. π/2k

Answer

39. Wavelength of the wave with 30 MHz frequency is
    - A. 1 cm
    - B. 10 cm
    - C. 100 cm
    - D. 1000 cm

Answer

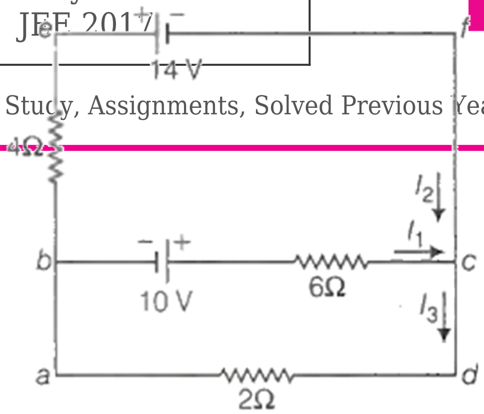
40. A copper wire with a cross-section area of 2 x10^{-6} m^2 has a free electron density equal to 5 x 10^{22} /cm^3. If this wire carries a current of 16 A, the drift velocity of the electron is
    - A. 1 m/s
    - B. 0.1 m/s
    - C. 0.01 m/s
    - D. 0.001 m/s

Answer

41. The resistance of the tungsten wire in the light bulb, which is 120V/75 W and powered by a 120 V direct current supply, is
    - A. 0.37 Ω
    - B. 1.2 Ω
    - C. 2.66 Ω
    - D. 192 Ω

Answer

42. The value of the current 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. $I_1 = 1A, I_2 = -3A, I_3 = -2A$

Answer

43. A silver wire has temperature coefficient of resistivity 4×10^{-3} / °C and its resistance at 20°C is 10 Ω. Neglecting any change in dimensions due to the change in temperature, its resistance at 40°C is

A. 0.8 Ω

B. 1.8 Ω

C. 9.2 Ω

D. 10.8 Ω

Answer

44. A charge Q placed at the centre 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. Q4πR12

C. Q4πR22

D. Q4π (R1 - R2)2

Answer

45. A sphere of radius R has a uniform volume charge density ρ. The magnitude of electric field at a distance r from the centre of the sphere, where r > R, is

A. ρ4πε0r2

B. ρR2ε0r2

C. ρR3ε0r2

D. ρR33ε0r2

Answer

46. Five equal point charges with Q = 10 nC are located at x = 2, 4, 5, 1 0 and 20 m. If ε_0 = [10^{-9} /

36π] F/m, then the potential at the origin (x = 0) is

A. 9.9 V

B. 11.1 V

C. 90 V

D. 99 V

Answer

47. 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 − 10 nC. The magnitude of the electric field between the plates, if ε0 = 10-936π F/m is

A. 0.6 π kV/m

B. 6 π kV/m

C. 600 π kV/m

D. 60 π V/m

Answer

48. A proton moves with a speed of 5.0 x 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° 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. 8.01 × 10^{-13} N

Answer

49. 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. μ0I02πr

B. μ0I02πR

C. μ0I0R22πr

D. μ0I0r22πR

Answer

50. If the cyclotron oscillator frequency is 16 MHz, then what should be the operating magnetic field for accelerating the proton of mass 1.67 x 10^{-27} kg ?

A. 0.334 πT

B. 3.34 πT

C. 33.4 πT

D. 334 πT

Answer

51. The direction of propagation of electromagnetic wave is along

A. Electric field vector, E

B. Magnetic field vector, B

C. E . B

D. E × B

Answer

52. Assume that a radio station is about 200 km away at your location and the station operates 972 kHz. How long does it take for an electromagnetic signal to travel from the station to you and how many wave crests does 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

Answer

53. The electric field portion of an electromagnetic wave is given by (all variables in SI units) $E = 10^{-4} \sin(6 \times 10^5 t - 0.01 x)$. The frequency (f) and the speed (v) of electromagnetic wave are

A. $f = 30/\pi$ kHz and $v = 1.5 \times 10^7$ m/s

B. $f = 90/\pi$ kHz and $v = 6.0 \times 10^7$ m/s

C. $f = 300/\pi$ kHz and $v = 6.0 \times 10^7$ m/s

D. $f = 600/\pi$ kHz and $v = 7.5 \times 10^7$ m/s

Answer

54. 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

Answer

55. 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

Answer

56. Consider a circular wire loop of radius R spinning about a diametrical chord which is perpendicular to uniform magnetic field B0k^

A. The magnitude of the induced EMF in the loop is maximum when the plane of the loop is perpendicular to B

B. Flux through the loop is maximum when the plane of the loop is perpendicular to 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

Answer

57. An electric motor which loaded has an effective resistance of 30 Ω and an inductive reactance of 40 Ω.If the motor is powered by a source with maximum voltage of 420 V, the maximum current is

A. 6 A

B. 8.4 A

C. 10 A

D. 12 A

Answer

58. If the rms value of sinusoidal input to a full wave rectifier is V0/2, then the rms value of the rectifier's output is

A. V0/2

B. V02/2

C. $V_0^2/2$

D. 2 V02

Answer

59. The speed of light in vacuum is equal to

A. $\mu_0\varepsilon_0$

B. $\mu_0^2\varepsilon_0^2$

C. 1μ0ε0

D. μ0ε0

Answer

60. In Young's double slits 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 original one will be

A. Unchanged

B. Halved

C. Doubled

D. Quadrupled

Answer

61. 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 x 10^5 m/s (Planck's constant = 6.6 x 10^{-34} J-s, rest mass of electron = 9 x 10^{-31} kg ?

A. 2/3 nm

B. 20/3 nm

C. 4/3 nm

D. 40/3 nm

Answer

62. Huygens' wave theory of light cannot explain

A. Diffraction phenomena

B. Interference phenomena

C. Photoelectric effect

D. Polarization of light

Answer

63. An electron, a neutron and an alpha particle have same kinetic energy and their de-Broglie wavelength are λ_e, λ_n, λ_α and 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. $\lambda_e > \lambda_n < \lambda_\alpha$

Answer

64. 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

Answer

65. In an insulator, band gap of the order of

A. 0.1 eV

B. 1 eV

C. 5 eV

D. 100 eV

Answer

66. For a P-N junction diode

A. Forward current in mA and reverse current is in μA

B. Forward current is in μA are reverse current is in mA

C. Both forward and reverse currents are in μA

D. Both forward and reverse currents are in mA

Answer

67. 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

Answer

68. Speech signals is in the range of

A. 3700 Hz to 7000 A∘ wavelength

B. 20 Hz to 20 kHz frequency

C. 300 Hz to 3100 Hz frequency

D. 540 kHz to 1600 kHz frequency

Answer

69. 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. $\omega_c - \omega_m$

Answer

70. Which of the following particle when bombards on ^{65}Cu will turn into ^{66}Cu ?

A. Proton

B. Neutron

C. Electron

D. Alpha particle

Answer

71. 8 g of Cu^{66} undergoes radioactive decay and after 15 minutes only 1 g 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

Answer

72. 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. $Z = A^2$

Answer