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Previous Year Paper

Physics - 2009

Multiple Choice Questions

1. The percentage errors in the measurement of length and time period of a simple pendulum are 1% and 2% respectively. Then the maximum error in the measurement of acceleration due to gravity is
   A. 8 %
   B. 3 %
   C. 5 %
   D. 6 %

Answer

2. Dimensional formula of Stefan's constant is
   A. $[MT^{-3}K^{-4}]$
   B. $[MLT^{-2}K^{-4}]$
   C. $[ML^{2}T^{-2}]$
   D. $[MT^{-2}L^{0}]$

Answer

3. A body is falling freely under gravity. The distances covered by the body in first, second and third minute of its motion are in the ratio
   A. 1 : 4 : 9
   B. 1 : 2 : 3
   C. 1 : 3 : 5
   D. 1 : 5 : 6

Answer

4. A bullet fired into a fixed wooden block loses half of its velocity after penetrating 40 cm. It comes to rest after penetrating a further distance of
   A. 223 cm
   B. 403 cm
   C. 203 cm
   D. 225 cm

Answer

5. A ball A is thrown up vertically with a speed u and at the same instant another ball B is released from a height h. At time t, the speed of A relative to B is
   A. u
   B. 2u

C. u − gt

D. u2 - gt

Answer

6. A bullet is to be fired with a speed of 2000 ms^{-1} to hit a target 200 m away on a level ground. If g = 10 ms^{-2}, the gun should be aimed

   A. directly at the target

   B. 5 cm below the target

   C. 5 cm above the target

   D. 2 cm above the target

Answer

7. The resultant of two vectors P→ and Q→ is R→. If the magnitude of Q→ is doubled, the new resultant becomes perpendicular to P→. Then the magnitude of R→ is

   A. P + Q

   B. Q

   C. P

   D. P + Q2

Answer

8. A motor car is moving with a speed of 20 ms^{-1} on a circular track of radius 100 m. If its speed is increasing at the, rate of 3 ms^{-1}, its resultant acceleration is

   A. 3 ms^{-2}

   B. 5 ms^{-2}

   C. 2.5 ms^{-2}

   D. 3.5 ms^{-2}

Answer

9. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off in two mutually perpendicular directions, one with a velocity of 3 i^ ms^{-1} and the other with a velocity of 4 j^ ms^{-1}. If the explosion occurs in 10^{-4} s, the average force acting on the third piece in newton is

   A. 3i^ + 4j^ × 10-4

   B. 3i^ - 4j^ × 10-4

   C. 3i^ + 4j^ × 104

   D. - 3i^ + 4j^ × 104

Answer

10. A mass of 1 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is 60°. The minimum force necessary to pull the mass up the inclined plane (g = 10 ms^{-2}) is

   A. 14.14 N

B. 17.32 N

C. 10 N

D. 16.66 N

Answer

11. A block of mass m is resting on a smooth horizontal surface. One end of a uniform rope of mass m3 is fixed to the block, which is pulled in the horizontal direction by applying force F at the other end. The tension in the middle of the rope is

 A. 87 F

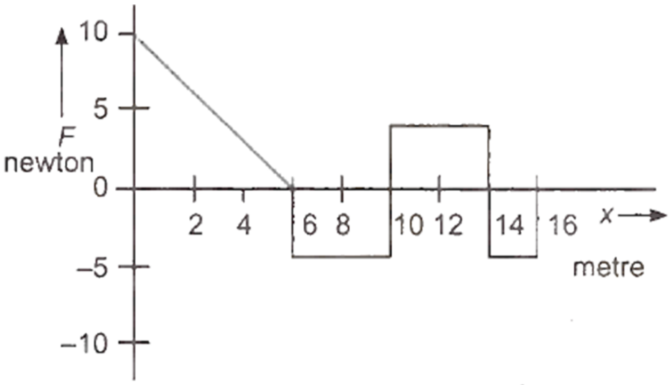
 B. 17 F

 C. 78 F

 D. 15 F

Answer

12. A particle is acted upon by a force F which varies with position x as shown in figure. If the particle at x = 0 has kinetic energy of 25 J, then the kinetic energy of the particle at x =16 m is



 A. 45 J

 B. 30 J

 C. 70 J

 D. 135 J

Answer

13. Two springs P and Q of force constants k_p and k_Q kQ = kp2 are stretched by applying forces of equal magnitude. If the energy stored in Q is E, then the energy stored in P is

 A. E

 B. 2E

 C. E2

 D. E4

Answer

14. A rod of mass m and length l is made to stand at an angle of 60° with the vertical. Potential energy of the rod in this position is

 A. mgl

 B. mgl2

 C. mgl3

D. mgl4

Answer

15. From a circular ring of mass M and radius R, an arc corresponding to a 90° sector is removed. The moment of inertia of the remaining part of the ring about an axis passing through the centre of the ring and perpendicular to the plane of the ring is k times MR^2. Then the value of k is

    A. 34

    B. 78

    C. 14

    D. 1

Answer

16. A system consists of 3 particles each of mass m located at points (1, 1), (2, 2) and (3, 3). The coordinates of the centre of mass are

    A. (6,6)

    B. (3,3)

    C. (1,1)

    D. (2,2)

Answer

17. A wheel of moment of inertia 2.5 kg-m^2 has an initial angular velocity of 40 $rads^{-1}$. A constant torque of 10 Nm acts on the wheel. The time during which the wheel is accelerated to 60 $rads^{-1}$ is

    A. 4 s

    B. 6 s

    C. 5 s

    D. 2.5 s

Answer

18. The ratio of radii of earth to another planet is 23and the ratio of their mean densities is 45. If an astronaut can jump to a maximum height of 1.5 m on the earth, with the same effort, the maximum height he can jump on the planet is

    A. 1 m

    B. 0.8 m

    C. 0.5 m

    D. 1.25 m

Answer

19. If an object of mass mis taken from the surface of earth (radius R) to a height 2R, then the work done is

    A. 2 mgR

    B. mgR

    C. 23 mgR

    D. 32 mgR

Answer

20. At what depth below the surface of the earth, the value of g is the same as that at a height of 5 km ?

    A. 1.25 km

    B. 2.5 km

    C. 10 km

    D. 7.5 km

Answer

21. A particle of mass m carrying charge q is kept at rest in a uniform electric field E and then released. The kinetic energy gained by the particle, when it moves through a distance y is

    A. 12 qEy2

    B. qEy

    C. qEy^2

    D. qE^2y

Answer

22. A small spherical ball falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius twice that of the earlier falling through the same viscous medium will have terminal velocity

    A. v

    B. v/4

    C. v/2

    D. 2v

Answer

23. The excess pressure inside a spherical drop of water is four times that of another drop. Then their respective mass ratio is

    A. 1 : 16

    B. 8 : 1

    C. 1 : 4

    D. 1 : 64

Answer

24. In a capillary rise experiment, the water level rises to a height of 5 cm. If the same capillary tube is placed in water such that only 3 cm of the tube projects outside the water level, then

    A. water will begin to overflow through the capillary

    B. angle of contact decreases

    C. angle of contact increases

    D. the meniscus completely vanishes

Answer

25. The Young's modulus of the material of a wire is 2×10^{10} Nm^{-2}. If the elongation strain is 1 %, then the energy stored in the wire per unit volume in Jm^{-3} is

A. 10^6

B. 10^8

C. 2×10^6

D. 2×10^8

Answer

26. The change in internal energy of a given mass of gas, when its volume changes from V to 2V at constant pressure p is CpCV = γ, universal gas constant = R

A. pVγ

B. pV2γ - 1

C. pVγ -1

D. Rγ - 1

Answer

27. In a Carnot engine, the temperature of reservoir is 927°C and that of sink is 27°C. If the work done by the engine when it transfers heat from reservoir to sink is 12.6×10^6 J, the quantity of heat absorbed by the engine from the reservoir is

A. 16.8×10^6 J

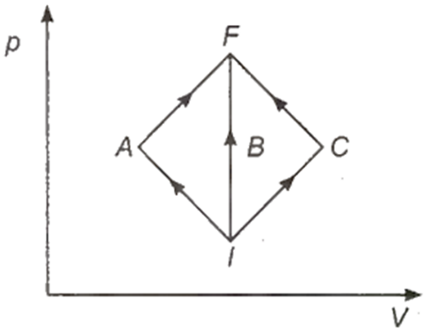
B. 4×10^6 J

C. 7.6×10^6 J

D. 4.25×10^6 J

Answer

28. In the given p-V diagram, I is the initial state and F is the final state.



The gas goes from I to F by

(i) IAF (ii) IBF (iii) ICF

The heat absorbed by gas is

A. the same in all three processes

B. the same in (i) and (ii)

C. greater in (i) than in (ii)

D. the same in (i) and (iii)

Answer

29. Hot water cools from 60°C to 50°C in the first 10 min and to 42°C in the next 10 min. The

temperature of the surroundings is

A. 10°C

B. 5°C

C. 15°C

D. 20°C

Answer

30. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.14 s. The frequencv of the wave is

A. 0.42 Hz

B. 2.75 Hz

C. 1.79 Hz

D. 0.56 Hz

Answer

31. An electric motor of mass 40 kg is mounted on four vertical springs each having a spring constant of 4000 Nm^{-1}. The period with which the motor vibrates vertically is

A. 0.314 s

B. 3.14 s

C. 0.628 s

D. 0.157 s

Answer

32. Two simple harmonic motions are represented by y1 = 4 sin (4πt + π/2) and y2 = 3 cos 4πt. The resultant amplitude is

A. 7

B. 1

C. 5

D. 2 + 3

Answer

33. An observer is approaching a stationary source with a velocity 14th of the velocity of sound. Then the ratio of the apparent frequency to actual frequency of source is

A. 4 : 5

B. 5 : 4

C. 2 : 3

D. 3 : 2

Answer

34. When a wave travels in a medium, the particle displacement is given by the equation y = a sin 2π bt - cx where a, b and c are constants. The maximum particle velocity will be twice the wave velocity, if

A. c = 1πa

B. c = πa

C. b = ac

D. b = 1ac

Answer

35. A progressive wave y = A sin kx - ωt is reflected by a rigid wall at x = 0. Then the reflected wave can be represented by

A. y = A sin (kx + ωt)

B. y = A cos (kx + ωt)

C. y = − A sin (kx − ωt)

D. y = − A sin (kx + ωt)

Answer

36. A heater of 220 V heats a volume of water in 5 min. The same heater when connected to 110 V heats the same volume of water in (minute)

A. 5

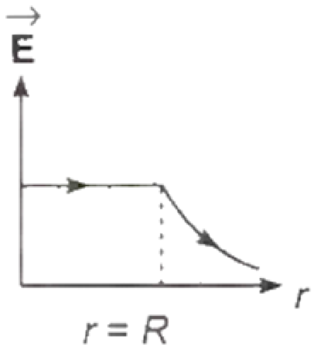
B. 20

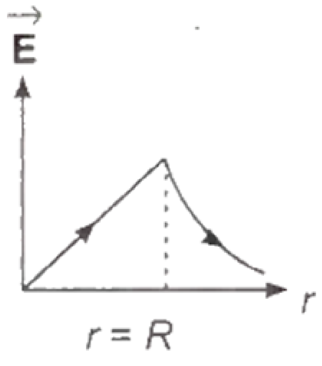
C. 10

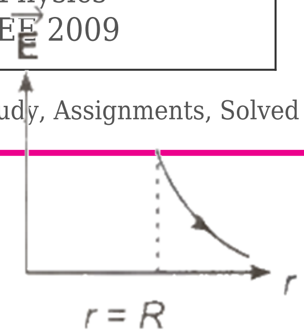
D. 2.5

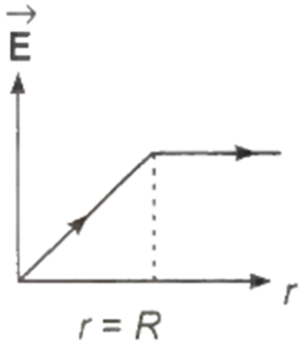
Answer

37. Which one of the following graphs represents the variation of electric field with distance r from the centre of a charged spherical conductor of radius R?

A. 

B. 

C. 

D. 

Answer

38. Two conducting spheres A and B of radius a and b respectively are at the same potential. The ratio of the surface charge densities of A and B is
    A. ba
    B. ab
    C. a2b2
    D. b2a2

Answer

39. Three charges 2q, -q, -q are located at the vertices of an equilateral triangle. At the circumcentre of the triangle
    A. the field is zero but potential is non-zero
    B. potential is zero and the field is infinity
    C. the field is non-zero but potential is zero
    D. both the field and potential are non-zero

Answer

40. C,V,U and Q are capacitance, potential difference, energy stored and charge of a parallel plate capacitor respectively. The quantities that increase when a dielectric slab is introduced between the plates without disconnecting the battery are
    A. V and C
    B. V and U
    C. U and Q
    D. V and Q

Answer

41. Two copper wires have their masses in the ratio 2 : 3 and the lengths in the ratio 3 : 4.The ratio of their resistances is

A. 4 : 9

B. 27 : 32

C. 16 : 9

D. 27 : 128

Answer

42. Two different conductors have same resistance at 0°C. It is found that the resistance of the first conductor at t_1°C is equal to the resistance of the second conductor at t_2°C. The ratio of the temperature coefficients of resistance of the conductors, α1α2 is

A. t1t2

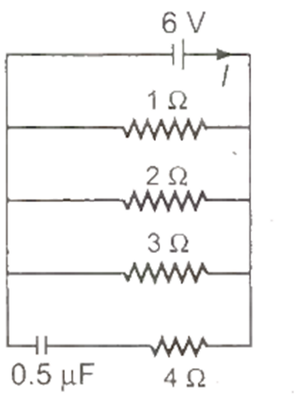
B. t2 - t1t2

C. t2 - t1t1

D. t2t1

Answer

43. In the given circuit diagram the current through the battery and the charge on the capacitor respectively in steady state are



A. 1 A and 3 μC

B. 17 A and 0 μC

C. 11 A and 3 μC

D. 6 A and 0 μC

Answer

44. A potentiometer wire of length 10 m and resistance 20 Ω is connected in series with a 15 V battery and an external resistance 40 Ω. A secondary cell of emf E in the secondary circuit is balanced by 240 cm long potentiometer wire. The emf E of the cell is

A. 2.4 V

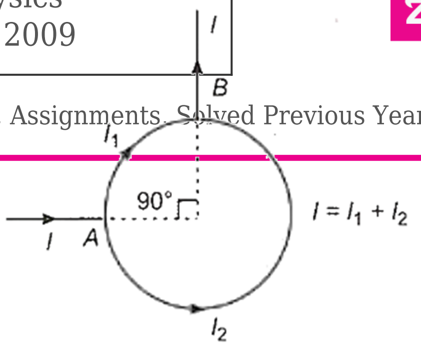
B. 1.2 V

C. 2.0 V

D. 3 V

Answer

45. A current I enters a circular coil of radius R, branches into two parts and then recombines as shown in the circuit diagram

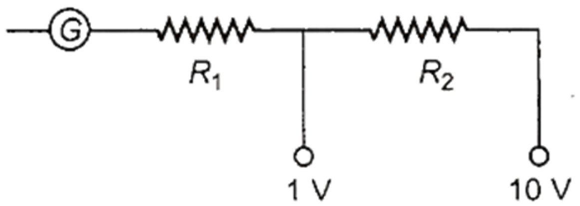


The resultant magnetic field at the centre of the coil is

A. zero
B. µ0I2R
C. 34 µ0I2R
D. 14 µ0I2R

Answer

46. The resistance of a galvanometer is 50 Ω and it shows full scale deflection for a current of 1 mA. To convert it into a voltmeter to measure 1 V and as well as 10 V (Refer circuit diagram) the resistances R_1 and R_2 respectively are



A. 950 Ω and 9150 Ω
B. 900 Ω and 9950 Ω
C. 900 Ω and 9900 Ω
D. 950 Ω and 9000 Ω

Answer

47. Two long parallel wires carry currents i_1 and i_2 such that $i_1 > i_2$. When the currents are in the same direction, the magnetic field at a point midway between the wires is 6 x 10^{-6} T. If the direction of i_2 is reversed, the field becomes 3 x 10^{-5} T. The ratio i1i2 is

A. 12
B. 2
C. 23
D. 32

Answer

48. A coil of 100 turns and area 2 x 10^{-2} m^2, pivoted about a vertical diameter in a uniform magnetic field carries a current of 5A. When the coil is held with its plane in North-South direction, it experiences a torque of 0. 3 Nm. When the plane is in East-West direction the torque is 0.4 Nm. The value of magnetic induction is (Neglect earth's magnetic field)

A. 0.2 T

B. 0.3 T

C. 0.05 T

D. 0.1 T

Answer

49. The angle of dip at a place is 37° and the vertical component of the earth's magnetic field is 6 x 10^{-5} T. The earth's magnetic field at this place is (tan 37° = 3/ 4)

A. 7×10^{-5} T

B. 6×10^{-5} T

C. 5×10^{-5} T

D. 10^{-4} T

Answer

50. The impedance of a R-C circuit is Z_1 for frequency f and Z_2 for frequency 2f. Then Z_1/Z_2 is

A. between 1 and 2

B. 2

C. 2 between 12 and 1

D. 12

Answer

51. In an L-C-R series AC circuit the voltage across L, C and R is 10 V each. If the inductor is short circuited, the voltage across the capacitor would become

A. 10 V

B. 202 V

C. 202 V

D. 102 V

Answer

52. A transformer of efficiency 90% draws an input power of 4 kW. An electrical appliance connected across the secondary draws a current of 6 A. The impedance of the device is

A. 60 Ω

B. 50 Ω

C. 80 Ω

D. 100 Ω

Answer

53. The inductance of a coil in which a current of 0.1 A increasing at the rate of 0.5 As^{-1} represents a power flow of 12 W, is

A. 2 H

B. 8 H

C. 20 H

D. 10 H

Answer

54. A point source of electromagnetic radiation has an average power output of 1500 W. The maximum value of electric field at a distance of 3 m from this source in Vm^{-1} is

A. 500

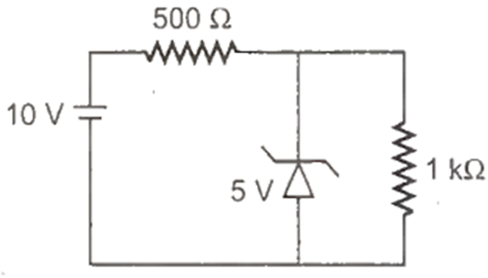
B. 100

C. 5003

D. 2503

Answer

55. In the following circuit, the current flowing through 1 kΩ resistor is



A. 0 mA

B. 5 mA

C. 10 mA

D. 15 mA

Answer

56. Electromagnetic waves of frequencies higher than 92 MHz are found to be reflected by the ionosphere on a particular day at a place. The maximum electron density in the ionosphere is

A. 5 × 1012 m-3

B. 2 × 1012 m-3

C. 2×10^{12} m^{-3}

D. 5×10^{12} m^{-3}

Answer

57. Which one of the following statements is wrong ?

A. Radio waves in the frequency range 30 MHz to 60 MHz are called sky waves.

B. Radio horizon of the transmitting antenna for space wave is dT = 2RhT (R = radius of earth, h_T = height of transmitting antenna)

C. Within the skip distance neither the ground waves nor the sky waves are received

D. The principle of fibre optical communication is total internal reflection

Answer

58. The refractive index and the permeability of a medium are respectively 1.5 and 5 x 10^{-7} Hm^{-1}. The relative permittivity of the medium is nearly

A. 25

B. 15

C. 6

D. 10

Answer

59. A square wire of side 1 cm is placed perpendicular to the principal axis of a concave mirror of focal length 15 cm at a distance of 20 cm. The area enclosed by the image of the wire is

 A. 4 cm^2
 B. 6 cm^2
 C. 9 cm^2
 D. 8 cm^2

Answer

60. A thin prism P of refracting angle 3° and refractive index 1.5 is combined with another thin prism Q of refractive index 1.6 to produce dispersion without deviation. Then the angle of prism Q is

 A. 3°
 B. 4°
 C. 3.5°
 D. 2.5°

Answer

61. Light of wavelength 6000 A° falls on a single slit of width 0.1 mm. The second minimum will be formed for the angle of diffraction of

 A. 0.08 rad
 B. 0.06 rad
 C. 0.012 rad
 D. 0.15 rad

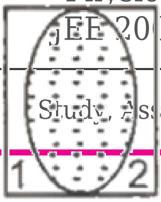
Answer

62. In a double slit experiment, the screen is placed at a distance of 1.25 m from the slits. When the apparatus is immersed in water (μ_w = 4/3), the angular width of a fringe is found to be 0.2°. When the experiment is performed in air with same set up, the angular width of the fringe is

 A. 0.4°
 B. 0.27°
 C. 0.35°
 D. 0.15°

Answer

63. Two piano-concave lenses (1 and 2) of glass of refractive index 1.5 have radii of curvature 25 cm and 20 cm. They are placed in contact with their curved surfaces towards each other and the space between them is filled with liquid of refractive index 43. Then the combination is



A. convex of focal length 70 cm

B. concave of focal length 70 cm

C. concave of focal length 66.6 cm

D. convex of focal length 66.6 cm

Answer

64. When a metallic surface is illuminated by a light of wavelength λ, the stopping potential for the photoelectric current is 3 V. When the same surface is illuminated by light of wavelength 2λ, the stopping potential is 1 V, the threshold wavelength for this surface is

A. 4 λ

B. 3.5 λ

C. 3 λ

D. 2.75 λ

Answer

65. The temperature at which protons in proton gas would have enough energy to overcome Coulomb barrier of 4.14 x 10^{-14} J is (Boltzmann constant = 1.38 x 10^{-23} JK^{-1})

A. 2×10^9 K

B. 10^9 K

C. 6×10^9 K

D. 3×10^9 K

Answer

66. The activity of a radioactive element decreases to one-third of the original activity A_0 in a period of 9 yr. After a further lapes of 9 yr, its activity will be

A. A_0

B. 23A0

C. A09

D. A06

Answer

67. Two nucleons are at a separation of 1 fermi. The net force between them is F_1 if both are neutrons, F_2 if both are protons and F_3 if one is proton and the other is a neutron. Then

A. $F_1 > F_2 > F_3$

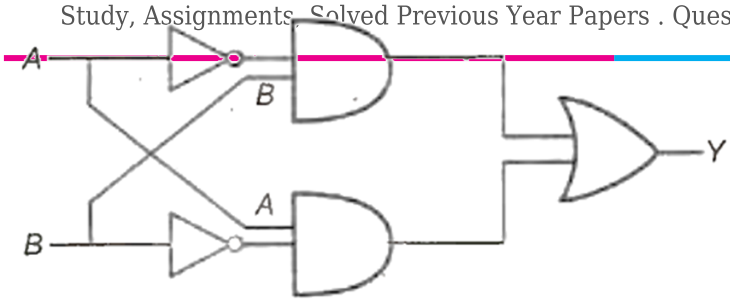
B. $F_1 = F_3 > F_2$

C. $F_2 > F_1 > F_3$

D. $F_1 = F_2 > F_3$

Answer

68. The truth table for the following logic circuit is



A. ABY000011101110

B. ABY000011101111

C. ABY001010101110

D. ABY001011100111

Answer

69. In the operation of n-p-n transistor compared to that of a triode, the p base acts as

A. emitter

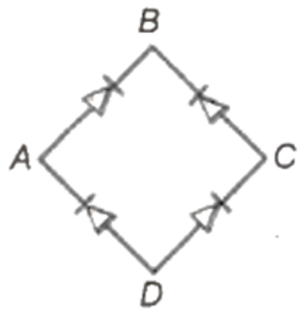
B. cathode

C. grid

D. plate

Answer

70. In the diagram, the input AC is across the terminals A and C. The output across B and D is



A. same as the input

B. half wave rectified

C. zero

D. full wave rectified

Answer

71. A diode AM detector with the output circuit consisting of R = 1kΩ and C = 1 μF would be more suitable for detecting a carrier signal of

A. 0.1 kHz

B. 0.5 kHz

C. 10 kHz

D. 0.75 kHz

Answer

72. In optical communication system operating at 1200 nm, only 2% of the source frequency is available for TV transmission having a bandwidth of 5 MHz. The number of TV channels that can be transmitted is

A. 2 million

B. 10 million

C. 0.1 million

D. 1 million

Answer