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Previous Year Paper

Physics - 2006



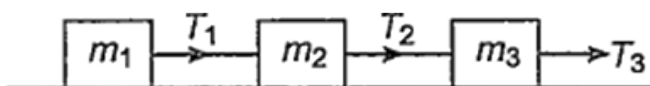
Multiple Choice Questions

1. To cover a population of 20 lakh, a transmission tower should have a height (Radius of earth = 6400 km, population per square km=1000)

A. 25 m
B. 50 m
C. 75 m
D. 100 m

Answer

2. Three blocks of masses m_1 , m_2 and m_3 are connected by massless string as shown kept on a frictionless table.



They are pulled with a force $T_3 = 40$ N. If $m_1 = 10$ kg, $m_2 = 6$ kg and $m_3 = 4$ kg, the tension T_2 will be

A. 20 N
B. 40 N
C. 10 N
D. 32 N

Answer

3. If the two vectors $\vec{A} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - n\hat{k}$ are perpendicular then the value of n is

A. 1
B. 2
C. 3
D. 4

Answer

4. A stone of mass m tied to a string of length l is rotating along a circular path with constant speed v . The torque on the stone is

A. mlv
B. $mv l$
C. zero

D. $mv^2 l$

5. LANDSAT series of satellites move in near polar orbits at an altitude of 3600 km.
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- A. 3600 km
B. 3000 km
C. 918 km
D. 512 km

Answer

6. A boat travels 50 km east, then 120 km North and finally it comes back to the starting point through the shortest distance. The total time of journey is 3 h. What is the average velocity, in km h^{-1} over the entire trip ?

- A. zero
B. 100
C. 17
D. 33.33

Answer

7. Potential energy in a spring when stretched by 2 cm is U. Its potential energy, when stretched by 10 cm is

- A. $U/5$
B. $U/2$
C. $25 U$
D. $5 U$

Answer

8. A toy cyclist completes one round of a square track of side 2 m in 40 s. What will be the displacement at the end of 3 min ?

- A. 52 m
B. zero
C. 16 m
D. 22 m

Answer

9. The mass of a planet is six times that of the earth. The radius of the planet is twice that of the earth. If the escape velocity from the earth is v , then the escape velocity from the planet is

- A. $3 v$
B. $2 v$
C. v
D. $5 v$

Answer

10. Two trains, each of length 200 m are running on parallel tracks. One overtakes the other in 20 s and one crosses the other in 10 s. The velocities of the two trains are

- A. 5 m/s, 10 m/s

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C. 15 m/s, 5 m/s

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D. 20 m/s, 21 m/s

Answer

11. The distance between the centres of carbon and oxygen atoms in the carbon monoxide molecule is $1.130 \text{ \AA}$. Locate the centre of mass of the molecule relative to the carbon atom
- A. $5.428 \text{ \AA}$
 - B. $1.130 \text{ \AA}$
 - C. $0.6457 \text{ \AA}$
 - D. $0.3260 \text{ \AA}$

Answer

12. Which of the following sets of quantities have same dimensional formula ?
- A. Frequency, angular frequency and angular momentum
 - B. Surface tension, stress and spring constant
 - C. Work, energy and torque
 - D. Thermal capacity, specific heat and entropy

Answer

13. A 20 kg ball moving with a velocity 6 m/s collides with a 30 kg ball initially at rest. If both of them coalesce, then the final velocity of the combined mass is
- A. 6 m/s
 - B. 5 m/s
 - C. 3.6 m/s
 - D. 2.4 m/s

Answer

14. A monkey climbs up and another monkey climbs down a rope hanging from a tree with same uniform acceleration separately. If the respective masses of monkeys are in the ratio 2 : 3, the common acceleration must be
- A. $g/5$
 - B. $6g$
 - C. $g/2$
 - D. g

Answer

15. A running man has the same kinetic energy as that of a boy of half his mass. The man speeds up by 2 ms^{-1} and the boy changes his speed by $x \text{ ms}^{-1}$, so that the kinetic energies of the boy and the man are again equal. Then x in ms^{-1} is
- A. - 22
 - B. + 22
 - C. 2

D. 2

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16. Two cars A and B are travelling in the same direction with velocities v_1 and v_2 ($v_1 > v_2$). When the car A is at a distance d behind the car B, the driver of the car A applies the brake producing uniform retardation, a . There will be no collision when

- A. $d < v_1 - v_2 2a$
- B. $d > v_1^2 - v_2^2 2a$
- C. $d > v_1 - v_2 2a$
- D. $d < v_1^2 - v_2^2 2a$

Answer

17. A symmetrical body is rotating about its axis of symmetry, its moment of inertia about the axis of rotation being 1 kgm^2 and its rate of rotation 2 rev/s . The angular momentum is

- A. $1.257 \text{ kg m}^2/\text{s}$
- B. $12.57 \text{ kg m}^2/\text{s}$
- C. $13.57 \text{ kg m}^2/\text{s}$
- D. $20 \text{ kg m}^2/\text{s}$

Answer

18. A car of mass 1000 kg moves on a circular track of radius 20 m . If the coefficient of friction is 0.64 , then the maximum velocity with which the car can move is

- A. 15 m/s
- B. 11.2 m/s
- C. 20 m/s
- D. 18 m/s

Answer

19. Two planets have radii r_1 and r_2 and densities d_1 and d_2 respectively. Then the ratio of acceleration due to gravity on them will be

- A. $r_1 d_1 : r_2 d_2$
- B. $r_1 d_2 : r_2 d_1$
- C. $r_1^2 d_1 : r_2^2 d_2$
- D. $r_1 : r_2$

Answer

20. A physical quantity P is related to four measurable quantities a , b , c and d as follows

$$P = a^3 b^2 c d$$

The percentage errors of measurement in a , b , c and d are 1% , 3% , 4% and 2% . The percentage error in the quantity P is

- A. 10%
- B. 13%

Answer

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21. The momentum of a body is increased by 25%. The kinetic energy is increased by about

A. 25 %
B. 5 %
C. 56 %
D. 38 %

Answer

22. A particle of mass $m = 5$ units is moving with a uniform speed $v = 32$ m in the XOY plane along the line $Y = X + 4$. The magnitude of the angular momentum about origin is

A. zero
B. 60 unit
C. 7.5 unit
D. 402 unit

Answer

23. A string of density 7.5 g cm^{-3} and area of cross-section 0.2 mm^2 is stretched under a tension of 20 N. When it is plucked at the mid-point, the speed of the transverse wave on the wire is

A. 116 ms^{-1}
B. 40 ms^{-1}
C. 200 ms^{-1}
D. 80 ms^{-1}

Answer

24. A work of $2 \times 10^{-2} \text{ J}$ is done on a wire of length 50 cm and area of cross-section 0.5 mm^2 . If the Young's modulus of the material of the wire is $2 \times 10^{10} \text{ Nm}^{-2}$, then the wire must be

A. elongated to 50.1414 cm
B. contracted by 2.0 mm
C. stretched by 0.707 mm
D. of length changed to 49.293 cm

Answer

25. Water rises in a capillary tube to a height h . Choose false statement regarding capillary rise from the following

A. On the surface of Jupiter, height will be less than h
B. In a lift moving up with constant acceleration height is less than h
C. On the surface of moon the height is more than h
D. In a lift moving down with constant acceleration height is less than h

Answer

26. The instantaneous displacement of a simple harmonic oscillator is given by $y = A \cos \omega t + \pi/4$. Its

speed will be maximum at the time

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B. $\omega 2\pi$

C. $\omega \pi$
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D. $\pi 4\omega$

Answer

27. A particle of mass 5 g is executing simple harmonic motion with amplitude of 0.3 m and time period $\pi/5$ s. The maximum value of the force acting on the particle is

A. 5 N

B. 4 N

C. 0.15 N

D. 0.3 N

Answer

28. In a gas, two waves of wavelengths 1 m and 1.01 m are superposed and produce 10 beats in 3 s. The velocity of sound in the medium is

A. 300 m/s

B. 336.7 m/s

C. 360.2 m/s

D. 270 m/s

Answer

29. The pressure inside two soap bubbles is 1.01 and 1.02 atmosphere respectively. The ratio of their respective volumes is

A. 2

B. 4

C. 6

D. 8

Answer

30. In a certain region of space there are only 5 molecules per cm^3 on an average. The temperature there is 3 K. The pressure of this dilute gas is ($k = 1.38 \times 10^{-23}$ J/K)

A. 20.7×10^{-17} N/m²

B. 15.3×10^{-15} N/m²

C. 2.3×10^{-10} N/m²

D. 5.3×10^{-5} N/m²

Answer

31. A simple pendulum has a time period T when on the earth's surface and T_2 when taken to a height 2R above the earth's surface where R is the radius of the earth. The value of (T_1 / T_2) is

A. 19

B. 13

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Answer

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32. The readings of a constant volume gas thermometer at 0°C and 100°C are 40 cm of mercury and 60 cm of mercury. If its reading at an unknown temperature is 100 cm of mercury column, then the temperature is
- 100°C
 - 50°C
 - 25°C
 - 300°C

Answer

33. In a cubic unit cell of bcc structure, the lattice points (i.e., number of atoms) are
- 2
 - 6
 - 8
 - 12

Answer

34. A 2 kg copper block is heated to 500°C and then it is placed on a large block of ice at 0°C . If the specific heat capacity of copper is $400 \text{ J kg}^{-1}\text{C}^{-1}$ and latent heat of fusion of water is $3.5 \times 10^5 \text{ J kg}^{-1}$ the amount of ice that can melt is
- $7/8 \text{ kg}$
 - $7/5 \text{ kg}$
 - $8/7 \text{ kg}$
 - $5/7 \text{ kg}$

Answer

35. Two identical springs, each of spring constant K , are connected first series and then in parallel. A mass M is suspended from them. The ratio of the frequencies of vertical oscillations will be
- 2 : 1
 - 1 : 1
 - 1 : 2
 - 4 : 1

Answer

36. A solid sphere of volume V and density ρ floats at the interface of two immiscible liquids of densities ρ_1 and ρ_2 respectively. If $\rho_1 < \rho_2$, then the ratio of volume of the parts of the sphere in upper and lower liquids is
- $\rho - \rho_2 : \rho_1 - \rho$
 - $\rho_2 - \rho : \rho - \rho_1$
 - $\rho + \rho_1 : \rho + \rho_2$
 - $\rho + \rho_2 : \rho + \rho_1$

Answer

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37. At a temperature of 30°C , the susceptibility of a ferromagnetic material is found to be χ . Its susceptibility at 333°C is

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- A. χ
 B. 0.5χ
 C. 2χ
 D. 0.09χ

Answer

38. Two identical air core capacitors are connected in series to a voltage source of 15 V. If one of the capacitors is filled with a medium of dielectric constant 4, the new potential across this capacitor is

- A. 5 V
 B. 8 V
 C. 10 V
 D. 12 V

Answer

39. In co-axial cable the material used as spacer is

- A. teflon (or) polyethylene
 B. glass or mica
 C. a gaseous medium
 D. glass

Answer

40. Two identical cells whether connected in parallel or in series gives the same current when connected to an external resistance 1.5Ω . Find the value of internal resistance of each cell.

- A. 1Ω
 B. 0.5Ω
 C. 1.5Ω
 D. zero

Answer

41. Force between two identical charges placed at a distance of r in vacuum is F . Now a slab of dielectric of dielectric constant 4 is inserted between these two charges. If the thickness of the slab is $r/2$, then the force between the charges will become

- A. F
 B. $35 F$
 C. $49 F$
 D. $F4$

Answer

42. A copper disc of radius 0.1 m is rotated about its centre with 20 rev/s in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is

- A. $\pi 20 \text{ V}$

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D. $10\pi \text{ mV}$

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43. A magnetised wire of magnetic moment M and length L is bent in the form of a semi circle of radius r . The new magnetic moment is

- A. M
- B. $M2\pi$
- C. $M\pi$
- D. $2M\pi$

Answer

44. A proton, a deuteron and an alpha particle with the same kinetic energy enter a region of uniform magnetic field B at right angles to the field. The ratio of the radii of their circular paths is

- A. $1 : 1 : 1$
- B. $1 : 2 : 2$
- C. $2 : 1 : 1$
- D. $2 : 2 : 1$

Answer

45. A solenoid 600 mm long has 50 turns on it and is wound on an iron rod of 7.5 mm radius. Find the flux through the solenoid when the current in it is 3 A. The relative permeability of iron is 600

- A. 1.66 Wb
- B. 1.66 n Wb
- C. 1.66 m Wb
- D. $1.66 \mu \text{ Wb}$

Answer

46. An electric dipole is placed at an angle of 30° with an electric field of intensity $2 \times 10^5 \text{ NC}^{-1}$. It experiences a torque equal to 4 Nm. Calculate the charge on the dipole if the dipole length is 2 cm.

- A. 8 mC
- B. 4 mC
- C. 2 mC
- D. $4 \mu \text{C}$

Answer

47. Two identical cells send the same current in 3Ω resistance, whether connected in series or in parallel. The internal resistance of the cell should be

- A. 1Ω
- B. 3Ω

C. 12Ω

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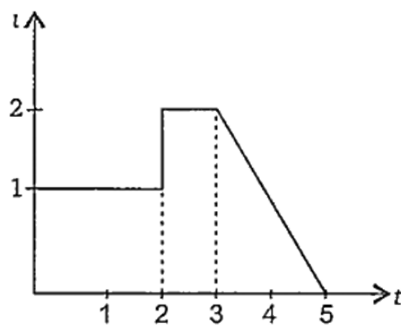
Answer

48. Which of the following statement is incorrect ?

- A. In LCR series AC circuit, as the frequency of the source increases, the impedance of the circuit first decreases and then increases
- B. If the net reactance of an LCR series AC circuit is same as its resistance, then the current lags behind the voltage by 45°
- C. At resonance, the impedance of an AC circuit becomes purely resistive
- D. At resonance in LCR series AC circuit, the potential drops across inductor and capacitor are equal in magnitude but opposite in sign

Answer

49. The plot represents the flow of current through a wire at three different times



The ratio of charges flowing through the wire at different times is

- A. 2 : 1 : 2
- B. 1 : 3 : 3
- C. 1 : 1 : 1
- D. 2 : 3 : 4

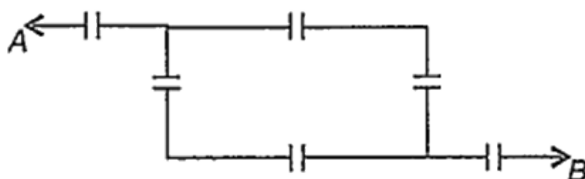
Answer

50. A varying magnetic flux linking a coil is given by $\phi = Xt^2$. If at time $t = 3$ s, the emf induced is 9 V, then the value of X is

- A. 0.66 Wb s^{-2}
- B. 1.5 Wb s^{-2}
- C. -0.66 Wb s^{-2}
- D. -1.5 Wb s^{-2}

Answer

51. A network of six identical capacitors, each of value C, is made as shown in the figure.



B. $3C/4$

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C. $3C/2$

D. $3C$

Answer

52. The amplitude of the sinusoidally oscillating electric field of a plane wave is 60 V/m. Then the amplitude of magnetic field is

A. 2×10^2 T

B. 6×10^7 T

C. 6×10^2 T

D. 2×10^{-7} T

Answer

53. The ratio of the resistance of conductor at temperature 15°C to its resistance at temperature 37.5°C is 4 : 5. The temperature coefficient of resistance the conductor is

A. 125°C^{-1}

B. 150°C^{-1}

C. 180°C^{-1}

D. 175°C^{-1}

Answer

54. Find the potential at the centre of a square of side 2 m which carries at its four corners charges

$$q_1 = 3 \times 10^{-6} \text{ C}, q_2 = -3 \times 10^{-6} \text{ C}, q_3 = -4 \times 10^{-6} \text{ C}, q_4 = 7 \times 10^{-6} \text{ C}$$

A. 2.7×10^4 V

B. 1.5×10^3 V

C. 3×10^2 V

D. 5×10^3 V

Answer

55. A short solenoid of length 4 cm, radius 2 cm and 100 turns is placed inside and on the axis of a long solenoid of length 80 cm and 1500 turns. A current of 3 A flows through the short solenoid. The mutual inductance of two solenoids is

A. 2.96×10^{-4} H

B. 5.3×10^{-5} H

C. 3.52×10^{-3} H

D. 8.3×10^{-5} H

Answer

56. In Young's experiment, using red light ($\lambda = 6600 \text{ \AA}$), 60 fringes are seen in the field of view.

How many fringes will be seen by using violet light ($\lambda = 4400 \text{ \AA}$) ?

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B. 20

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D. 90

Answer

57. The range of frequencies allotted for FM radio is

A. 88 to 108 kHz

B. 88 to 108 MHz

C. 47 to 230 kHz

D. 47 to 230 MHz

Answer

58. The binding energy per nucleon for deuteron and helium are 1.1 MeV and 7.0 MeV. The energy released when two deuterons fuse to form a helium nucleus is

A. 23.6 MeV

B. 2.2 MeV

C. 30.2 MeV

D. 3.6 MeV

Answer

59. The surface area of a black body is $5 \times 10^{-4} \text{ m}^2$ and its temperature is 727°C . The energy radiated by it per minute is ($\sigma = 5.67 \times 10^{-8} \text{ J/m}^2 \text{ s-k}^4$)

A. $1.7 \times 10^3 \text{ J}$

B. $2.5 \times 10^2 \text{ J}$

C. $8 \times 10^3 \text{ J}$

D. $3 \times 10^4 \text{ J}$

Answer

60. The inputs and outputs for different time intervals are given below the NAND gate

Time	Input A	Input B	Output Y
t_1 to t_2	0	1	P
t_2 to t_3	0	0	Q
t_3 to t_4	1	0	R
t_4 to t_5	1	1	S

The values taken by P, Q, R, S are respectively

A. 1, 1, 1, 0

B. 0, 1, 0, 1

C. 0, 1, 0, 0

D. 1, 0, 1, 1

Answer

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61. A ray of light passes from vacuum into a medium of refractive index μ , the angle of incidence is found to be twice the angle of refraction. Then the angle of incidence is
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- A. $\cos^{-1} \mu^2$
 B. $2 \cos^{-1} \mu^2$
 C. $2 \sin^{-1} \mu$
 D. $2 \sin^{-1} \mu^2$

Answer

62. If α and β are the current gain in the CB and CE configurations respectively of the transistor circuit, then $\beta - \alpha\beta$
- A. infinite
 B. 1
 C. 2
 D. 0.5

Answer

63. The apparent frequency of the whistle of an engine changes in the ratio 9 : 8 as the engine passes a stationary observer. If the velocity of the sound is 340 ms^{-1} , then the velocity of the engine is
- A. 40 ms^{-1}
 B. 20 ms^{-1}
 C. 340 ms^{-1}
 D. 180 ms^{-1}

Answer

64. The width of a single slit if the first minimum is observed at an angle 2° with a light of wavelength $6980 \text{ \AA}$
- A. 0.2 mm
 B. $2 \times 10^{-5} \text{ mm}$
 C. $2 \times 10^5 \text{ mm}$
 D. 2 mm

Answer

65. A silicon specimen is made into a p-type semiconductor by doping, on an average, one indium atom per 5×10^7 silicon atoms. If the number density of atoms in the silicon specimen is $5 \times 10^{28} \text{ atom/m}^3$, then the number of acceptor atoms in silicon per cubic centimetre will be
- A. $2.5 \times 10^{30} \text{ atom/cm}^3$
 B. $2.5 \times 10^{35} \text{ atom/cm}^3$
 C. $1 \times 10^{13} \text{ atom/cm}^3$
 D. $1 \times 10^{15} \text{ atom/cm}^3$

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66. In a photoelectric effect measurement, the stopping potential for a given metal is found to be V_0 when radiation of wavelength λ_0 is used. If radiation of wavelength $2\lambda_0$ is used with the same metal then the stopping potential (in volt) will be

- A. $V_0/2$
- B. $2V_0$
- C. $V_0 + \frac{hc}{2e\lambda_0}$
- D. $V_0 - \frac{hc}{2e\lambda_0}$

Answer

67. In artificial radioactivity, 1.414×10^6 nuclei are disintegrated into 10^6 nuclei in 10 min. The half-life in minutes must be

- A. 5
- B. 20
- C. 15
- D. 30

Answer

68. If ϵ_0 and μ_0 are the electric permittivity and magnetic permeability of free space and ϵ and μ are the corresponding quantities in the medium, the index of refraction of the medium in terms of above parameter is

- A. $\epsilon\mu\epsilon_0\mu_0$
- B. $\epsilon\mu\epsilon_0\mu_0^{1/2}$
- C. $\epsilon_0\mu_0\epsilon\mu$
- D. $\epsilon_0\mu_0\epsilon\mu^{1/2}$

Answer

69. A light ray of $5895 \text{ \AA}$ wavelength travelling in vacuum enters a medium of refractive index 1.5. The speed of light in the medium is

- A. $3 \times 10^8 \text{ m/s}$
- B. $2 \times 10^8 \text{ m/s}$
- C. $1.5 \times 10^8 \text{ m/s}$
- D. $6 \times 10^8 \text{ m/s}$

Answer

70. The half-life of radon is 3.8 days. How many radon will be left out of 1024 mg after 38 days

- A. 1 mg
- B. 2 mg
- C. 3 mg
- D. 4 mg

Answer

71. In a common-emitter amplifier, the load resistance of the output circuit is 1000 times the

resistance of the input circuit. If $\alpha = 0.98$, then voltage gain is

A. 49×10^3

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~~B. 2.5×10^2~~

C. 1.5×10^2

D. 4.9

Answer

72. The plane faces of two identical plano-convex lenses each having a focal length of 50 cm are placed against each other to form a usual biconvex lens. The distance from this lens combination at which an object must be placed to obtain a real, inverted image which has the same size as the object is

A. 50 cm

B. 25 cm

C. 100 cm

D. 40 cm

Answer