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## **Previous Year Paper**

**Physics - 2013**

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## Multiple Choice Questions

1. The quantity which has the same dimensions as that of gravitational potential is

- A. latent heat
- B. impulse
- C. angular acceleration
- D. Planck's constant

Answer

2. The percentage error in measuring M, L and T are 1 %, 1.5% and 3% respectively. Then the percentage error in measuring the physical quantity with dimensions  $[ML^{-1}T^{-1}]$  is

- A. 1 %
- B. 3.5 %
- C. 5.5 %
- D. 4.5 %

Answer

3. From an elevated point P, a stone is projected vertically upwards when the stone reaches a distance h below P, its velocity is double of its velocity at a height h above P. The greatest height attained by the stone from the point of projection is

- A. 35 h
- B. 53 h
- C. 57 h
- D. 23 h

Answer

4. The distance x covered by a particle varies with time t as  $x^2 = 2t^2 + 6t + 1$ . Its acceleration varies with x as

- A. x
- B.  $x^2$
- C.  $x^{-1}$
- D.  $x^{-3}$

Answer

5. A particle describes uniform circular motion in a circle of radius 2 m, with the angular speed of 2 rad  $s^{-1}$ . The magnitude of the change in its velocity in  $\pi/2$  s is

A. 0  $ms^{-1}$

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C.  $8 \text{ ms}^{-1}$

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D.  $4 \text{ ms}^{-1}$

Answer

6. A body projected at an angle with the horizontal has a range 300 m. If the time of flight is 6 s, then the horizontal component of velocity is

A.  $30 \text{ ms}^{-1}$

B.  $50 \text{ ms}^{-1}$

C.  $40 \text{ ms}^{-1}$

D.  $45 \text{ ms}^{-1}$

Answer

7. A constant force  $F$  acts on a particle of mass 1 kg moving with a velocity  $v$ , for one second. The distance moved in that time is

A. 0

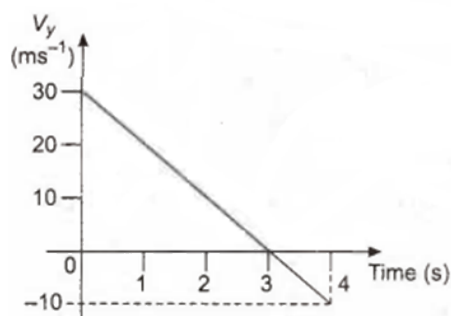
B.  $F^2$

C.  $v + F^2$

D.  $2F$

Answer

8. The velocity-time graph for the vertical component of the velocity of a body thrown upwards from the ground and landing on the roof of a building is given in the figure. The height of the building is



A. 50 m

B. 40 m

C. 20 m

D. 30 m

Answer

9. A spacecraft of mass 100 kg breaks into two when its velocity is  $10^4 \text{ ms}^{-1}$ . After the break, a mass of 10 kg of the spacecraft is left stationary. The velocity of the remaining part is

A.  $10^3 \text{ ms}^{-1}$

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Answer

10. A particle tied to a string describes a vertical circular motion of radius  $r$  continually. If it has a velocity  $3gr$  at the highest point, then the ratio of the respective tensions in the string holding it at the highest and lowest points is
- A. 4 : 3
  - B. 5 : 4
  - C. 1 : 4
  - D. 3 : 2

Answer

11. In a uniform circular motion, the angle between the velocity and acceleration is
- A. 0
  - B.  $45^\circ$
  - C.  $90^\circ$
  - D.  $75^\circ$

Answer

12. A crate is pushed horizontally with 100 N across a 5 m floor. If the frictional force between the crate and the floor is 40 N, then the kinetic energy gained by the crate is
- A. 200 J
  - B. 240 J
  - C. 250 J
  - D. 300 J

Answer

13. The potential energy of a conservative system is given by  $V(x) = (x^2 - 3x)$  joule, where  $x$  is measured in metre. Then its equilibrium position is at
- A. 1.5 m
  - B. 2 m
  - C. 3 m
  - D. 1 m

Answer

14. An engine pumps out water continuously through a hose with a velocity  $v$ . If  $m$  is the mass per unit length of the water jet, the rate at which the kinetic energy is imparted to water is
- A.  $12 mv^2$
  - B.  $12 mv^3$
  - C.  $12 m^2v^2$
  - D.  $mv^3$

Answer

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15. A body of mass 1.5 kg rotating about an axis with angular velocity of  $0.3 \text{ rad s}^{-2}$  has the angular momentum of  $1.8 \text{ kg m}^2 \text{ s}^{-2}$ . The radius of gyration of the body about an axis is

- A. 2 m  
B. 1.2 m  
C. 0.2 m  
D. 1.6 m

Answer

16. In a two-particle system with particle masses  $m_1$  and  $m_2$ , the first particle is pushed towards the centre of mass through a distance  $d$ , the distance through which second particle must be moved to keep the centre of mass at the same position is
- A.  $m_2 d m_1$   
B.  $d$   
C.  $m_1 d m_2$   
D.  $m_1 d m_1 + m_2$

Answer

17. The principle involved in the performance of a spinning-chair circus acrobat is
- A. conservation of angular momentum  
B. conservation of linear momentum  
C. conservation of energy  
D. principle of moment

Answer

18. Two bodies of masses 4 kg and 9 kg are separated by distance of 60 cm. A 1 kg mass is placed in between these two masses. If the net force on 1 kg is zero, then its distance from 4 kg mass is
- A. 26 cm  
B. 30 cm  
C. 24 cm  
D. 32 cm

Answer

19. The total energy and kinetic energy of an Earth's satellite are respectively
- A. positive and negative  
B. negative and positive  
C. positive and positive  
D. negative and negative

Answer

20. If the earth is one-fourth of its present distance from the sun, the duration of the year will be changed to
- A. half of the present year  
B. 14th of the present year  
C. 18th of the present year

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Answer

21. Two spherical rain drops with radii in the ratio 1 : 2 fall from a great height through the atmosphere. The ratio of their momenta after they have attained terminal velocity is
- A. 1 : 8
  - B. 2 : 1
  - C. 1 : 32
  - D. 1 : 2

Answer

22. The angle of dip at a place where horizontal and vertical components of Earth's magnetic field are equal is
- A.  $45^\circ$
  - B.  $30^\circ$
  - C.  $0^\circ$
  - D.  $60^\circ$

Answer

23. The radiating power of a linear antenna of length  $l$  for a wave of wavelength is proportional to
- A.  $l\lambda$
  - B.  $l^2\lambda^2$
  - C.  $l\lambda^2$
  - D.  $l\lambda$

Answer

24. A ball falling in a lake of depth 400 m has a decrease of 0.2% in its volume at the bottom. The bulk modulus of the material of the ball is (in  $\text{Nm}^{-2}$ )
- A.  $9.8 \times 10^9$
  - B.  $9.8 \times 10^{10}$
  - C.  $1.96 \times 10^9$
  - D.  $9.8 \times 10^{11}$

Answer

25. Three capillary tubes of same length but internal radii 0.3 mm, 0.45 mm and 0.6 mm are connected in series and a liquid flows steadily through them. If the pressure difference across the third capillary is 8.1 mm of mercury, the pressure difference across the first capillary (in mm of mercury) is
- A. 16.2
  - B. 32.4
  - C. 129.6
  - D. 2.025

Answer

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one of the pans of a balance so that it comes in contact with the water in a vessel. If surface tension of water is  $70 \times 10^{-3} \text{ Nm}^{-1}$ , then the extra mass in the other pan required to pull the ring away from water is

- A. 2 g
- B. 3 g
- C. 4.4 g
- D. 15 g

Answer

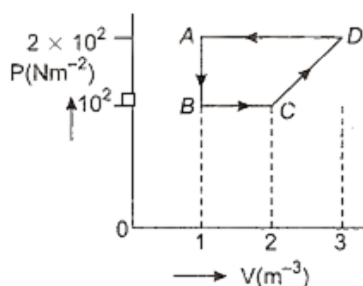
27. If the temperatures of source and sink of a Carnot engine having efficiency  $\eta$  are each decreased by 100 K, then the efficiency
- A. remains constant
  - B. becomes 1
  - C. decreases
  - D. increases

Answer

28. If the time taken by a hot body to cool from  $50^\circ\text{C}$  to  $40^\circ\text{C}$  is 10 min when the surrounding temperature is  $25^\circ\text{C}$ , then the time taken for it to cool from  $40^\circ\text{C}$  to  $30^\circ\text{C}$  when the surrounding temperature is  $15^\circ\text{C}$ , is
- A. 40 min
  - B. 10 min
  - C. 5 min
  - D. 15 min

Answer

29. The p-V diagram of a gas system undergoing cyclic process is shown here. The work done during isobaric compression is



- A. 100 J
- B. 200 J
- C. 400 J
- D. 500 J

Answer

30. In a cyclic process, the amount of heat given to a system is equal to
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A. net increase in internal energy

B. net work done by the system

C. net decrease in internal energy

D. net change in volume

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**Answer**

31. A particle is executing simple harmonic motion with amplitude A. When the ratio of its kinetic energy to the potential energy is 14, its displacement from its mean position is
- A.  $25A$
  - B.  $32A$
  - C.  $34A$
  - D.  $14A$

**Answer**

32. The ratio of amplitudes of two simple harmonic motions represented by the equations  $y_1 = 5 \sin 2\pi t + \pi/4$  and  $y_2 = 22 \sin 2\pi t + \cos 2\pi t$  is
- A. 1 : 1
  - B. 2 : 1
  - C. 5 : 2
  - D. 5 : 4

**Answer**

33. The displacement of a particle in SHM is  $x = 10 \sin 2t - \pi/6$  m. When its displacement is 6 m, the velocity of the particle (in  $\text{ms}^{-1}$ ) is
- A. 8
  - B. 24
  - C. 16
  - D. 10

**Answer**

34. The bulk modulus of a liquid of density  $8000 \text{ kgm}^{-3}$  is  $2 \times 10^9 \text{ Nm}^{-2}$ . The speed of sound in that liquid is (in  $\text{ms}^{-1}$ )
- A. 200
  - B. 250
  - C. 500
  - D. 350

**Answer**

35. The vibrations of a string of length 60 cm fixed at both the ends are represented by the equation  $y = 2 \sin 4\pi x/15 \cos 96\pi t$ , where x and y are in cm. The maximum number of loops that can be formed in it, is
- A. 6
  - B. 16



Answer

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36. The pressure variations in the propagation of sound waves are

- A. isobaric
- B. isochoric
- C. isobaric and isochoric
- D. adiabatic

Answer

37. A steel plate of size 6 cm x 6 cm is to be coated by a metal on both sides with a coating thickness of 0.1 mm by electrolysis. If the density and ece of the metal are respectively  $10 \text{ g cm}^{-3}$  and  $0.001 \text{ gC}^{-1}$  then the strength of the current to complete the process in one hour is

- A. 1 A
- B. 0.5 A
- C. 6 A
- D. 2 A

Answer

38. A signal of 5 kHz frequency modulates a carrier of frequency 1 MHz and peak voltage 25 V. If the amplitude at the sidebands of the amplitude modulated signal is 5 V, then the modulation index is

- A. 0.8
- B. 0.6
- C. 0.4
- D. 0.2

Answer

39. An uncharged parallel plate capacitor filled with a dielectric of dielectric constant K is connected to an air filled identical parallel capacitor charged to potential  $V_1$ . If the common potential is  $V_2$ , the value of K is

- A.  $V_1 - V_2V_1$
- B.  $V_1V_1 - V_2$
- C.  $V_2V_1 - V_2$
- D.  $V_1 - V_2V_2$

Answer

40. When a comb rubbed with dry hair attracts pieces of paper. This is because the

- A. comb polarizes the piece of paper
- B. comb induces a net dipole moment opposite to the direction of field
- C. electric field due to the comb is uniform
- D. comb induces a net dipole moment perpendicular to the direction of field

Answer

41. If the electric flux entering and leaving a closed surface are  $6 \times 10^6$  and  $9 \times 10^6$  SI units

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- A.  $\epsilon_0 \times 10^6$   
 B.  $-\epsilon_0 \times 10^6$   
 C.  $-2\epsilon_0 \times 10^6$   
 D.  $3\epsilon_0 \times 10^6$

Answer

42. Choose the wrong statement about equipotential surfaces.

- A. It is a surface over which the potential is constant  
 B. The electric field is parallel to the equipotential surface  
 C. The electric field is perpendicular to the equipotential surface  
 D. The electric field is in the direction of steepest decrease of potential

Answer

43. Three capacitors connected in series have an effective capacitance of  $4 \mu\text{F}$ . If one of the capacitance is removed, the net capacitance of the capacitor increases to  $6 \mu\text{F}$ . The removed capacitor has a capacitance of

- A.  $2 \mu\text{F}$   
 B.  $4 \mu\text{F}$   
 C.  $10 \mu\text{F}$   
 D.  $12 \mu\text{F}$

Answer

44. Resistance of  $12 \Omega$  and  $X \Omega$  are connected in parallel in the left gap and resistances of  $9 \Omega$  and  $7 \Omega$  are connected in series in the right gap of the meter bridge. If the balancing length is  $36 \text{ cm}$ , then the value of resistance  $X$  is

- A.  $72 \Omega$   
 B.  $54 \Omega$   
 C.  $36 \Omega$   
 D.  $64 \Omega$

Answer

45. Ten identical batteries each of emf  $2 \text{ V}$  are connected in series to a  $8 \Omega$  resistor. If the current in the circuit is  $2 \text{ A}$ , then the internal resistance of each battery is

- A.  $0.2 \Omega$   
 B.  $0.3 \Omega$   
 C.  $0.4 \Omega$   
 D.  $0.5 \Omega$

Answer

46. In a potentiometer of wire length  $l$ , a cell of emf  $V$  is balanced at a length  $l_3$  from the positive of the wire. For another cell of emf  $1.5 \text{ V}$ , the balancing length becomes

A.  $l_3$

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C. 13

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D. 213

Answer

47. The smallest resistance that can be obtained by combining 10 resistors each of resistance  $10\ \Omega$  is

- A.  $10\ \Omega$
- B.  $0.5\ \Omega$
- C.  $1\ \Omega$
- D.  $20\ \Omega$

Answer

48. Pick out the wrong statement from the following

- A. The SI unit of conductance is mho
- B. Conductance of a conductor decreases with increase in temperature
- C. The relation between voltage and current for a non-ohmic conductor is linear
- D. If the length of the metallic wire is doubled, its resistivity remains unchanged

Answer

49. The magnetic field at a point midway between two parallel long wires carrying currents in the same direction is  $10\ \mu\text{T}$ . If the direction of the smaller current among them is reversed, the field becomes  $30\ \mu\text{T}$ . The ratio of the larger to the smaller current in them is

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

Answer

50. An AC source of voltage  $E = 20 \sin 100 t$  is connected across a resistance  $20\ \Omega$ . The rms value of current in the circuit is

- A. 1 A
- B. 12 A
- C. 12 A
- D. 22 A

Answer

51. A given resistor has the following colour code of the various strips on it : Brown, black, green and silver. The value of its resistance in ohm is

- A.  $1.0 \times 10^4 \pm 10\%$
- B.  $1.0 \times 10^7 \pm 5\%$
- C.  $1.0 \times 10^6 \pm 10\%$
- D.  $1.0 \times 10^5 \pm 5\%$

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Answer

A. the impedance is equal to reactance

B. the ratio between effective voltage to effective current is called reactance

C. at resonance the net reactance is zero

D. at resonance the resistance is equal to the reactance

Answer

53. A 100 turns coil of area of cross-section  $200 \text{ cm}^2$  having  $2 \Omega$  resistance is held perpendicular to a magnetic field of  $0.1 \text{ T}$ . If it is removed from the magnetic field in one second, the induced charge produced in it is

A.  $0.2 \text{ C}$

B.  $2 \text{ C}$

C.  $0.1 \text{ C}$

D.  $1 \text{ C}$

Answer

54. The self-inductance of an air core solenoid of 100 turns is  $1 \text{ mH}$ . The self-inductance of another solenoid of 50 turns (with the same length and cross-sectional area) with a core having relative permeability 500 is

A.  $125 \text{ mH}$

B.  $24 \text{ mH}$

C.  $60 \text{ mH}$

D.  $30 \text{ mH}$

Answer

55. A step-down transformer with an efficiency of  $80\%$  is used on a  $1000 \text{ V}$  line to deliver  $10 \text{ A}$  at  $100 \text{ V}$  at the secondary coil. The current drawn from the line is

A.  $1.5 \text{ A}$

B.  $2 \text{ A}$

C.  $3 \text{ A}$

D.  $1.25 \text{ A}$

Answer

56. Identify the wrong statement

A. Eddy currents are produced in a steady magnetic field

B. Eddy currents can be minimized by using laminated core

C. Induction furnace uses eddy current to produce heat

D. Eddy current can be used to produce braking force in moving vehicles

Answer

57. If the magnetic field of an electromagnetic wave is given as  $B_y = 2 \times 10^{-7} \sin(10^3 x + 1.5 \times 10^{12} t)$  tesla, the wavelength of the electromagnetic wave is

A.  $0.314 \text{ mm}$

B.  $0.628 \text{ mm}$

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D. 1.26 mm

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Answer

58. The electromagnetic waves travel with

- A. the same speed in all media
- B. the speed of sound in free space
- C. the speed of light  $c = 3 \times 10^8 \text{ ms}^{-1}$  in free space
- D. the speed of light  $c = 3 \times 10^8 \text{ ms}^{-1}$  in fluid medium

Answer

59. If an ideal junction diode is connected as shown, then the value of the current  $i$  is



- A. 0.013 A
- B. 0.02 A
- C. 0.01 A
- D. 0.1 A

Answer

60. The focal lengths of the objective and the eyepiece of the telescope are 225 cm and 5 cm respectively. The magnifying power of the telescope will be

- A. 49
- B. 45
- C. 35
- D. 60

Answer

61. The angle of incidence for an equilateral prism of refractive index 3 so that the ray is parallel to the base inside the prism is

- A.  $30^\circ$
- B.  $20^\circ$
- C.  $60^\circ$
- D.  $45^\circ$

Answer

62. If the intensity ratio of two coherent sources used in Young's double slit experiment is 49 : 1, then the ratio between the maximum and minimum intensities in the interference pattern is

- A. 1 : 9
- B. 9 : 16
- C. 16 : 9
- D. 16 : 25

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63. According to Rayleigh scattering law, the amount of scattering is

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- A. directly proportional to wavelength of light
- B. directly proportional to square of wavelength of light
- C. inversely proportional to fourth power of wavelength of light
- D. inversely proportional to wavelength of light

Answer

64. The de-Broglie wavelength and kinetic energy of a particle is  $2000 \text{ \AA}$  and  $1 \text{ eV}$  respectively. If its kinetic energy becomes  $1 \text{ MeV}$ , then its de-Broglie wavelength is

- A.  $2 \text{ \AA}$
- B.  $1 \text{ \AA}$
- C.  $4 \text{ \AA}$
- D.  $10 \text{ \AA}$

Answer

65. The work functions of two metals are  $2.75 \text{ eV}$  respectively. If these are irradiated by photons of energy  $3 \text{ eV}$ , the ratio of maximum momenta of the photoelectrons emitted respectively by them is

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

Answer

66. A radioactive material of half-life time of  $69.3 \text{ days}$  kept in a container.  $23 \text{ rd}$  of the substance remains undecayed after (given,  $\ln 2 = 0.693$ )

- A.  $20 \text{ days}$
- B.  $25 \text{ days}$
- C.  $35 \text{ days}$
- D.  $40 \text{ days}$

Answer

67. The maximum kinetic energy of photoelectrons

- A. depends on collector plate
- B. is independent of emitter plate material
- C. is independent of frequency of incident radiation
- D. depends on the frequency of light source and the nature of emitter plate material

Answer

68. Identify the mismatched pair from the following

- A. Zener diode : Voltage regulator
- B. Germanium doped with phosphorus : n-type semiconductor
- C. semiconductor : band gap  $> 3 \text{ eV}$
- D. p-n junction diode : rectifier

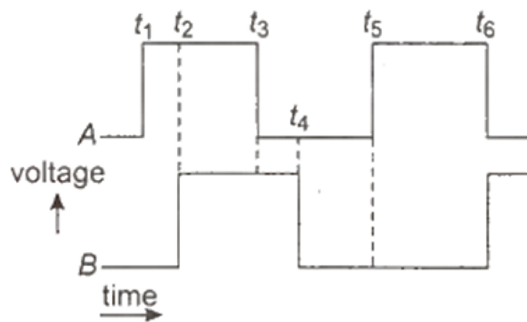
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69. In a common-emitter configuration, a transistor has  $\beta = 50$  and input resistance  $1 \text{ k}\Omega$ . If the peak value of AC input is  $0.01 \text{ V}$ , then the peak value of collector current is

- A.  $0.01 \mu\text{A}$
- B.  $500 \mu\text{A}$
- C.  $100 \mu\text{A}$
- D.  $0.5 \mu\text{A}$

Answer

70. The waveforms A and B given below are given as input to a NAND gate. Then, its logic output y is



- A. for  $t_1$  to  $t_2$  ;  $y = 0$
- B. for  $t_2$  to  $t_3$  ;  $y = 1$
- C. for  $t_3$  to  $t_4$  ;  $y = 1$
- D. for  $t_4$  to  $t_5$  ;  $y = 0$

Answer

71. A repeater is a combination of
- A. receiver and modulator
  - B. receiver and transducer
  - C. receiver and transmitter
  - D. receiver and amplifier

Answer

72. Find the mismatch
- A. Sky wave communication : Frequency upto  $30 \text{ MHz}$
  - B. Line of sight communication : Frequency greater than  $40 \text{ MHz}$
  - C. Mobile telephony : Frequency range  $800 - 950 \text{ kHz}$
  - D. Facsimile : Static document

Answer