SOLVED PAPER
AIIMS - 2013*

Time : 3½ Hours | Max. Marks : 200

PHYSICS

1. For satellite communication which wave is used ?
(a) Space wave (b) Sky wave
(c) Ground wave (d) Microwave

2. In nuclear fission, which of the following quantity is conserved ?
(a) Energy
(b) Mass
(c) Momentum
(d) Both energy and mass.

3. When a slow neutron is captured by a $^{235}_{92}U$ nucleus, a fission energy releasing 200 MeV. If power of nuclear reactor is 100 W then rate of nuclear fission is
(a) $3.6 \times 10^{6}\ s^{-1}$ (b) $3.1 \times 10^{12}\ s^{-1}$
(c) $1.8 \times 10^{4}\ s^{-1}$ (d) $4.1 \times 10^{6}\ s^{-1}$

4. A ball of mass m is tied up with string and rotated along a horizontal circle of radius r. At an instant, its velocity is v, and tension in string is T, the force required for circular motion is
(a) $T - \frac{mv^2}{r}$ (b) $T + \frac{mv^2}{r}$
(c) $\frac{mv^2}{r}$ (d) zero

5. If modulation index is 1/2 and power of carrier wave is 2 W. Then what will be the total power in modulated wave?
(a) 0.5 W (b) 1 W
(c) 0.25 W (d) 2.25 W

6. If velocity of a particle is three times of that of electron and ratio of de Broglie wavelength of particle to that of electron is 1.814×10^{-4}. The particle will be
(a) Neutron (b) Deutron
(c) Alpha (d) Tritium

7. A dipole of dipole moment 'p' is placed in non-uniform electric field along x-axis. Electric field is increasing at the rate of 1 V m^{-1} then the force on dipole is
(a) 0 (b) $2p$
(c) $p/2$ (d) p

8. Dimensional formula of angular momentum is
(a) ML^2T^{-1} (b) $M^2L^2T^{-2}$
(c) ML^2T^{-3} (d) MLT^{-1}

9. Relation between magnetic moment and angular velocity is
(a) $M \propto \omega$ (b) $M \propto \omega^2$
(c) $M \propto \sqrt{\omega}$ (d) None of these

10. In an intrinsic semiconductor band gap is 1.2 eV then ratio of number of charge carriers at 600 K and 300 K is
(a) 10^4 (b) 10^7 (c) 10^5 (d) 10^3

11. Gravitational potential of the body of mass m at a height h from surface of earth of radius R is (Take g = acceleration due to gravity at earth's surface)
(a) $-g(R + h)$ (b) $-g(R - h)$
(c) $g(R + h)$ (d) $g(R - h)$

12. Which of the following is the best method to reduce eddy currents?
(a) Laminating core (b) Using thick wires
(c) Reducing hysteresis loss
(d) None of these

13. In a cyclic process, work done by the system is
(a) zero
(b) more than the heat given to the system
(c) equal to heat given to the system
(d) independent of heat given to system

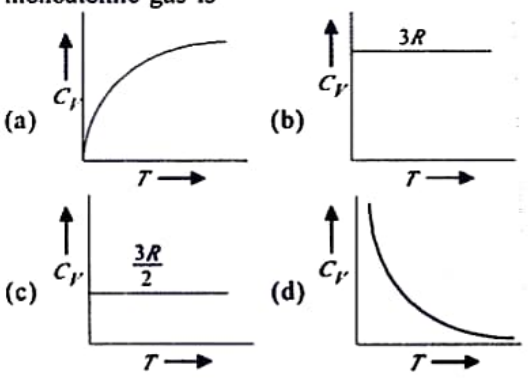
14. In a cylinder their are 60 g Ne and 64 g O_2. If pressure of mixture of gases in cylinder is 30 bar then in this cylinder partial pressure of O_2 is (in bar)
(a) 30 (b) 20 (c) 15 (d) 12

* *Based on memory.* Courtesy : **Allen Career Institute**, Kota (Rajasthan)

15. A gas mixture contain one mole O_2 gas and one mole He gas. Find the ratio of specific heat at constant pressure to that at constant volume of the gaseous mixture.
(a) 2 (b) 1.5
(c) 2.5 (d) 4

16. One mole of oxygen of volume 1 litre at 4 atm pressure to attains 1 atm pressure by result of isothermal expansion. Find work done by the gas.
(a) = 155 J (b) = 206 J
(c) = 355 J (d) = 552 J

17. Graph of specific heat at constant volume for a monoatomic gas is



18. Given that force $(5\hat{i}+7\hat{j}-3\hat{k})$ N acts on a particle at position $(\hat{i}+\hat{j}-\hat{k})$ m. Find torque of this force on the particle about origin.
(a) $4\hat{i}-2\hat{j}+2\hat{k}$ (b) $2\hat{i}-3\hat{j}+4\hat{k}$
(c) $5\hat{i}-2\hat{j}+3\hat{k}$ (d) $6\hat{i}-4\hat{j}+4\hat{k}$

19. Astronomical wavelength increase due to doppler effect known as
(a) Red shift (b) Voilet shift
(c) UV (d) IR shift

20. Long distance communication between two point on earth is achieved by
(a) Space wave communication
(b) Sky wave communication
(c) Satellite wave communication
(d) Line of sight transmission

21. Which of the following is not a state function?
(a) Work-done in adiabatic process.
(b) Work done in isothermal process.
(c) Heat at constant pressure.
(d) Heat at constant volume.

22. In an oscillating system, a restoring force is a must. In an L-C circuit, restoring force is provide by
(a) capacitor (b) inductance
(c) resistance (d) both (a) and (b)

23. Polaroid glass is used in sun glasses because
(a) it reduces the light intensity to half on account of polarisation
(b) it is fashionable
(c) it has good colour
(d) it is cheaper

24. Which of the following statement is incorrect?
(a) Neutron is less stable than proton
(b) Neutron can cause fission in nuclear reactors but proton can not.
(c) A free proton can emit beta particle.
(d) A bound proton can emit beta particle.

25. Electric field at a distance r from infinitely long conducting sheet is proportional to
(a) r^{-1} (b) r^{-2}
(c) $r^{-3/2}$ (d) independent of r

26. Given that the mobility of electrons in Ge is 0.4 $m^2 V^{-1} s^{-1}$ and electronic charge is 1.6×10^{-19}C. The number of donor atom (per m^3) semiconductor of conductivity 500 mho/m is
(a) 8×10^{21} (b) 8×10^{15}
(c) 5×10^{21} (d) 8×10^{16}

27. In a Young's double slit experiment the spacing between the slits is 0.3 mm and the screen is kept at a distance of 1.5 m. The second bright fringe is found 6 mm from the central fringe. The wavelength of the light used in the experiment is
(a) 625 nm (b) 600 nm
(c) 550 nm (d) 500 nm

28. In beta plus decay
(a) antineutrino is produced with electron
(b) neutrino is produced with positron
(c) neutron is produced with electron
(d) none of these

29. A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude 'a' and time period 'T'. The speed of the pendulum at $x = a/2$ will be
(a) $\frac{\pi a}{T}$ (b) $\frac{3\pi^2 a}{T}$

(c) $\frac{\pi a\sqrt{3}}{T}$ (d) $\frac{\pi a\sqrt{3}}{2T}$

30. A particle is projected from the ground with an initial speed of 'v' at angle θ with horizontal. The average velocity of the particle between its point of projection and height point of trajectory is

(a) $\frac{v}{2}\sqrt{1+2\cos^2\theta}$ (b) $\frac{v}{2}\sqrt{1+\cos^2\theta}$

(c) $\frac{v}{2}\sqrt{1+3\cos^2\theta}$ (d) $v\cos\theta$

31. The frequency of a light wave in a material is 2×10^{14} Hz and wavelength is 5000 Å. The refractive index of material will be

(a) 1.50 (b) 3.00 (c) 1.33 (d) 1.40

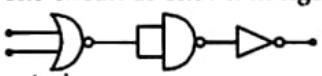
32. Two solenoids of equal number of turns having their length and the radii in the same ratio 1 : 2. The ratio of their self-inductance will be

(a) 1 : 2 (b) 2 : 1 (c) 1 : 1 (d) 1 : 4

33. A circuit consisting of five resistors each of resistance R, forming a Wheatstone bridge. What is the equivalent resistance of the circuit?

(a) $2R$ (b) R
(c) $2R/3$ (d) $R/2$

34. The circuit as shown in figure,



the equivalent gate is

(a) NOR gate (b) OR gate
(c) AND gate (d) NAND gate

35. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 62°C, its efficiency is doubled. The temperature of source will be

(a) 37° C (b) 62° C
(c) 99° C (d) 124° C

36. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{i}-4\hat{j}+\alpha\hat{k}$, then value of α is

(a) -1 (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) 1

37. 1 g of steam is sent into 1 g of ice. At thermal equilibrium, the resultant temperature of mixture is

(a) 270°C (b) 230°C
(c) 100°C (d) 120°C

38. Ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is

(a) $\frac{7}{29}$ (b) $\frac{9}{31}$ (c) $\frac{5}{27}$ (d) $\frac{3}{23}$

39. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to

(a) $\frac{(\gamma-1)}{R}$ (b) γR

(c) $\frac{1+\gamma}{1-\gamma}$ (d) $\frac{R}{(\gamma-1)}$

40. A body of mass m is taken from the earth's surface to the height equal to twice the radius(R) of the earth. The change in potential energy of body will be

(a) $3mgR$ (b) $\frac{1}{3}mgR$

(c) $2mgR$ (d) $\frac{2}{3}mgR$

Directions : In the following questions (41-60), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true but reason is false.
(d) If both assertion and reason are false.

41. **Assertion** : In a communication system based on amplitude modulation the modulation index is kept < 1.
Reason : It ensures minimum distortion of signal.

42. **Assertion** : If optical density of a substance is more than that of water then the mass density of substance can be less than water.
Reason : Optical density and mass density are not related.

43. **Assertion** : On going away from a point charge or a small electric dipole, electric field decreases at the same rate in both the cases.
Reason : Electric field is inversely proportional to square of distance from the charge or on electric dipole.

44. **Assertion** : If a conductor is given charge then no excess inner charge appears.
Reason : Electric field inside conductor is zero.

45. **Assertion** : Water kept in an open vessel will quickly evaporate on the surface of the moon.
Reason : The temperature at the surface of the moon is much higher than the boiling point of water.

46. **Assertion** : Moment of inertia is always constant.
Reason : Angular moment is conserved that is why moment of inertia is constant.

47. **Assertion** : Magnetic lines forms closed loops in nature.
Reason : Mono-magnetic pole does not exist in nature.

48. **Assertion** : Gaussian surface is considered carefully.
Reason : The point where electric field to be calculated should be with in the surface.

49. **Assertion** : $^{60}_{27}Co$ is a source of gamma radiation.
Reason : Gamma emission is due to nuclear decay.

50. **Assertion** : When light ray is incident at polarising angle on glass, refracted light is partially polarised.
Reason : The intensity of light decreases in polarisation.

51. **Assertion** : A laser beam of 0·2 W power can drill holes through a metal sheet, whereas a 1000 W torch-light cannot.
Reason : The frequency of laser light is much higher than that of torch light.

52. **Assertion** : Electromagnetic radiations exert pressure.
Reason : Electromagnetic-waves carry both momentum and energy.

53. **Assertion** : Electric appliances with metallic body. *e.g.*, heaters, presses etc., have three pin connections, whereas an electric bulb has a two pin connection.
Reason : Three pin connections reduce heating of connecting cables.

54. **Assertion** : Total current entering a circuit is equal to leaving the circuit by Kirchhoff's law.
Reason : It is based on conservation of energy.

55. **Assertion** : The sun rises some time before the actual sun-rise.
Reason : Because of the refraction through the different layers of atmosphere.

56. **Assertion** : Centre of mass of a system does not move under the action of internal forces.
Reason : Internal forces are non conservative forces.

57. **Assertion** : Total energy is negative for a bound system.
Reason : Potential energy of a bound system is negative and more than kinetic energy.

58. **Assertion** : A undamped spring-mass system is simplest free vibration system.
Reason : It has three degrees of freedom.

59. **Assertion** : Magnetic field is useful in producing parallel beam of charged particle.
Reason : Magnetic field inhibits the motion of charged particle moving across it.

60. **Assertion** : Resolving power of a telescope depends only on wavelength.
Reason : This is proportional to square of wavelength.