PHYSICS

1. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is

a) $[ML^{-3}TA]$ b) $[M^0LT^{-2}A^0]$

c) $[ML^1T^{-2}A^{-1}]$ **d)** $[ML^2T^{-2}A^0]$

2. A train is moving along a straight line with a constant acceleration a. A boy standing in the train throws a ball forward with a speed of 10 m/s, at an angle of 60^o to the horizontal. The boy has to move forward by 1.15 m inside the train to catch the ball back at the initial height. The acceleration of the train, in m/s^2, is.

a) 5 b) 7

c) 0.5 d) 10

3. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time

a) at the mean position of the platform

b) for an amplitude of g/ω^2

c) for an amplitude of g^2/ω^2

d) at the highest position of the platform

4. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of

a) $(2/3)\,k$ **b)** $(3/2)\,k$

c) $3\,k$ d) $6\,k$

5. Four point masses, each of value m, are placed at the corners of a square, ABCD of side l. The moment of inertia of this system about an axis passing through A and paralled to BD is

a) $2ml^2$ **b)** $\sqrt{3}\,ml^2$

c) $3\,ml^2$ d) ml^2

6. A smooth sphere A is moving on a frictionless horizontal plane with angular velocity ω and centre of mass velocity v. It collides elastically and head on with an identical sphere B at rest. Neglect friction everywhere. After the collision their angular speeds are ω_A and ω_B respectively. Then,

a) $\omega_A < \omega_B$ b) $\omega_A = \omega_B$

c) $\omega_A = \omega$ d) $\omega_B = \omega$

7. Which of the following statements is true?

a) A clock when taken on a mountain can be made to give correct time if we change the length of pendulum suitably

b) An increase in value of g makes a clock go slow

c) If the length of a pendulum is increased, the clock becomes fast

d) A clock when taken to a deep mine or carried to the top of a mountain becomes slow

8. The density of newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the plane would be

a) $2R$ b) $4R$

c) $¼R$ **d)** $½R$

9. The velocity with which a projectile must be fired so that it escapes earth's gravitation does not depend on

a) mass of the earth

b) mass of the projectile

c) radius of the projectile's orbit

d) gravitational constant

10. An iron rod of length 2 m and cross-sectional area of 50mm ^{2} is stretched by 0.5mm, when a mass of 250 kg is hung from its lower end. Young's modulus of iron rod is

a) $19.6 \times 10^{20}\ Nm^{-2}$ b) $19.6 \times 10^{18}\ Nm^{-2}$

c) $19.6 \times 10^{10}\ Nm^{-2}$ d) $19.6 \times 10^{15}\ Nm^{-2}$

11. One end of a horizontal thick copper wire of length $2L$ and radius $2R$ is welded to an end of another horizontal thin copper wire of length L and radius R. When the arrangement is stretched by applying forces at two ends, the ratio of the elongation in the thin wire to that in the thick wire is

a) 0.25 b) 0.50

c) 2.00 d) 4.00

12. **Assertion** : Taking into account the fact that any object which floats must have an average density less than that of water, during world war I, a number of cargo vessels were made of concrete.
Reason: Concrete cargo vessels were filled with air

a) Both assertion and reason are true and reason is the correct explanation of assertion.

b) Both assertion and reason are true but reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Both assertion and reason are false.

13. When an ideal diatomic gas is heated at constant pressure the fraction of the heat energy supplied which increases the internal energy of the gas is

a) 2/5 b) 3/5

c) 3/7 **d)** 5/7

14. The ratio of the speed of sound in nitrogen gas to that in helium gas, at 300 K is

a) $\sqrt{(2/7)}$ b) $\sqrt{(1/7)}$

c) $(\sqrt{3})/5$ d) $(\sqrt{6})/5$

15. An ideal gas is expanding such that pT^2 =constant. The coefficient of volume expansion of the gas is

a) 1/T b) 2/T

c) 3/T d) 4/T

16. The ratio of the vapour densities of two gases at a given temperature is 9 : 8. The ratio of the rms velocities of their molecules is

a) $3:2\sqrt{2}$ **b)** $2\sqrt{2}:3$

c) 9 : 8 d) 8 : 9

17. A vessel contains 32 g of O_2 at a temperature T. The pressure of the gas is p. An identical vessel containing 4 g of H_2 at a temperature 2T has a pressure of

a) $8p$ **b)** $4p$

c) p b) $p/8$

18. The speed of sound in hydrogen at NTP is 1270 ms^{-1}. Then, the speed in a mixture of hydrogen and oxygen in the ratio 4 : 1 by volume will be

a) $317 ms^{-1}$ **b)** $635\ ms^{-1}$

c) $830\ ms^{-1}$ d) $950\ ms^{-1}$

19. Two cylinders fitted with pistons contain equal amounts of an ideal diatomic gas at 300 K. The piston of A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of gas in A is 300 K, then rise in temperature of gas in B is

a) 30 K b) 18 K

c) 50 K **d)** 42 K

20. A comb run through one's dry hair attracts small bits of paper. This is due to

a) comb is a good conductor

b) paper is a good conductor

c) the atoms is the paper get polarised by the charged comb

c) The comb possesses magnetic properties

21. A table tennis ball which has been covered with a conducting paint is suspended by a silk thread so that it hangs between two mental plates. One plate is earthed. When the other plate is connected to a high voltage generator, the ball

a) is attracted to the high voltage plate and stays there

b) hangs without moving

c) swings backward and forward hitting each plate in turn

d) is repelled to the earthed plate and stays there

22. In a potentiometer arrangement, a cell of emf 1.5V gives a balance point at 27 cm length of wire, If the cell is replaced by another cell and balance point shifts to 54 cm , the emf of the second cell is

a) 3V b) 1.5 V

c) 0.75V d) 2.25V

23. The maximum current that can be measured by a galvanometer of resistance 40Ω is 10mA. It is converted into a voltmeter that can read upto 50V. The resistance to be connected in series with the galvanometer (in ohm) is

a) 2010 b) 4050

c) 5040 **d)** 4960

24. A piece of copper and another of germanium are cooled from room temperature to 80K. The resistance of

a) each of them increases

b) each of them decreases

c) copper increases and germanium decreases

d) copper decreases and germanium increases

25. A steady current flows in a metallic conductor of non-uniform cross-section. The quantity/ quantities constant along the length of the conductor is/are

a) current, electric field and drift speed

b) drift speed only

c) current and drift speed

d) current only

26. A long hollow copper tube carries a current I. Then which of the following will be true?

a) The magnetic field B will be zero at all points inside the tube

b) The magnetic filed B will be zero only at points on the axis of the tube

c) The magnetic field B will be maximum at points on the axis of the tube

d) The magnetic field will be zero at any point outside the tube

27. An electron having mass (9.1×10^{-31}kg) and charge (1.6×10^{-19}C) moves in a circular path of radius 0.5 m with a velocity 10^6 ms^{-1} in a magnetic field strength of magnetic field is

a) 1.13×10^{-5} T b) 5.6×10^{-6} T

c) 2.8×10^{-6} T d) None of these

28. A charged particle is released from rest in a region of steady and uniform electric and magnetic fields which are parallel to each other. The particle will move in a

a) straight line b) circle

c) helix d) cycloid

29. A uniformly wound solenoid coil of self-inductance 1.8×10^{-4} H and resistance 6Ω is broken up into two identical coils. These identical coils are then connected in parallel across a 12 V battery of negligible resistance. The time constant for the current in the circuit is

a) 0.1×10^{-4}s b) 0.2×10^{-4}s
c) 0.3×10^{-4}s d) 0.4×10^{-4}s

30. An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased

a) the bulb glow dimmer
b) the bulb glows brighter
c) total impedance of the circuit is unchanged
d) total impedance of the circuit increases

31. A solenoid has an inductance of 10 H and a resistance of 2Ω. It is connected to a 10 V battery. How long will it take for the magnetic energy to reach 1/4 of its maximum value?

a) 3.465 sec
b) 3.654 sec
c) 3 sec
d) 2.46 sec

32. If alpha, beta and gamma rays carry same momentum, which has the longest wavelength?

a) Alpha rays
b) Beta rays
c) Gamma rays
d) None, all have same wavelength

33. What is order of energy of X-rays (E_X), radio wave (E_R) and microwaves (E_M)?

a) $E_X<E_R<E_M$ **b)** $E_X>E_M>E_R$
c) $E_M>E_X>E_R$ b) $E_M<E_R<E_X$

34. In a wave motion $y=a$ sin $(kx-\omega t)$, y can represent

a) Electric field **b)** Magnetic field
c) displacement **d)** pressure

35. Two tuning forks with natural frequencies of 340 Hz each move relative to a stationary observer. One fork moves away from the observer, while the other moves towards him at the same speed. The observer hears beats of frequency 3 Hz. Find the speed of the tuning fork. Speed of sound =340m/s.

a) 1.5 m/s
b) 5.1 m/s
c) 1.3 m/s
d) 1.15 m/s

36. Consider Fraunhofer diffraction pattern obtained with a single slit at normal incidence. At the angular position of first diffraction minimum, the phase difference between the wavelets from the opposite edges of the slit is

a) π/4 b) π/2
c) π **d)** 2π

37. Specific rotation of sugar solution is 0.01 SI units. 200 kg-m^{-3} of impure sugar solution is taken in a polarimeter tube of length 0.25 m and an optical rotation of 0.4 rad is observed. The percentage of purity of sugar in the sample is

a) 11% b) 20%
c) 80% d) 89%

38. In case of linearly polarised light, the magnitude of the electric field vector

a) does not charge with time
b) varies periodically with time
c) increases and decreases linearly with time
d) is parallel to the direction of propagation

39. A prism of refracting angle 30^{O} is coated with a thin film of transparent material of refractive index 2.2 on face AC of the prism. A light of wavelength 6600 A^{O} is incident on face AB such that angle of incidence is 60^{O}, the angle of emergence is

a) 0
b) 1
c) 0.01
d) 0.1

40. A ray of light travelling in water is incident on its surface open to air. The angle of incidence is Θ, which is less than the critical angle. Then there will be

a) only a reflected ray and no refracted ray
b) only a refracted ray and no reflected ray
c) a reflected ray and a refracted ray and the angle between them would be less than 180^{O}-2Θ
d) a reflected ray and a refracted ray and the angle between them would be greater than 180^{O}-2Θ

41. Two beams of red and violet colours are made to pass separately through a prism (angle of the prism is 60^{O}). In the position of minimum deviation, the angle of refraction will be

a) 30^{O} for both the colours
b) greater for the violet colour
c) greater for the red colour
d) equal but not 30^{O} for both the colors

42. The exposure time of a camera lens at $\frac{f}{2.8}$ setting is $\frac{1}{200}$ s. The correct exposure time at $\frac{f}{5.6}$ setting is

a) 0.02 s
b) 0.04 s
c) 0.20 s
d) 0.40 s

43. X-rays are produced in an X-ray tube operating at a given accelerating voltage. The wavelength of the continues X-rays has values from

a) 0 to ∞
b) λ_{min} to ∞ where $\lambda_{min} > 0$
c) 0 to λ_{max} to where $\lambda_{max} < \infty$
d) λ_{min} to λ_{max} where $0 < \lambda_{min} < \lambda_{max} < \infty$

44. Half-life of radioactive substance A is 4 days. The probability that a nucleus will decay in two half-lives is

a) 1/4
b) 3/4
c) 1/2
d) 1

45. An α-particle and a proton are acclerated from rest by a potential difference of 100 V. After this, their de-Broglie wavelengths are λ_{α} and λ_{p} respectively.

The ratio $\frac{\lambda_p}{\lambda_\alpha}$, to the nearest integer, is

a) 1
b) 3
c) 6
d) 4

46. The activity of a freshly prepared radioactive sample is 10^{10} disintegrations per second, whose mean life is 10^{-9}s. The mass of an atom of this radioisotope is 10^{-25} kg. The mass (in mg) of the radioactive sample is

a) 0.5
b) 3
c) 1
d) 2

47. The potential difference applied to an X-ray tube is increased. As a result, in the emitted radiation

a) the intensity increases
b) the minimum wavelength increases
c) the intensity remains unchanged
d) the minimum wavelength decreases

48. The gate for which output is high, if at least one input is low?

a) NAND b) NOR

c) AND d) OR

49. Which of the following statements is true for an n-type semiconductor?

a) The donor level lies closely below the bottom of the conduction band.

b) The donor level lies closely above the top of the valence band

c) The donor level lies at the halfway mark of the forbidden energy gap.

d) None of the above

50. Copper has face-centred cubic (fcc) lattice with interatomic spacing equal to 2.54Å. The value of lattice constant for this lattice is

a) 1.27 Å b) 5.08 Å

c) 2.54 Å **d)** 3.59 Å