PHYSICS

1. An object of size 10 cm is kept at a distance of 10 cm from a convex lens. If the focal length of the lens is 5 cm, the size of the image is
   a) 10 cm
   b) 20 cm
   c) 5 cm
   d) 15 cm

2. A biconvex lens of focal length 10 cm is to be made from a glass material. If the refractive index of the material is 1.5, what must be the radius of curvature of the surface of the lens?
   a) 0.1 m
   b) 0.15 m
   c) 0.20 m
   d) 0.30 m

3. A diffraction grating with 10^6 lines / m is used to determine the wavelength of a monochromatic source. The angle of first order diffraction is 30°. The wavelength of the source is
   a) 1000 nm
   b) 500 nm
   c) 400 nm
   d) 600 nm

4. A glass plate of thickness 1.5 μm and refractive index 1.5 is introduced between one of the slits and screen in a Young's double slit experiment. If the wavelength of the monochromatic source used is $\lambda = 0.75$ μm, the phase difference between the interfering waves at the centre of the screen is equal to
   a) 6π
   b) 3π
   c) π
   d) 2π

5. What is the velocity of light in a medium with refractive index 1.5?
   a) 2×10^8 m/s
   b) 3×10^8 m/s
   c) 1.5×10^8 m/s
   d) 2.5×10^8 m/s

6. Which among the following electromagnetic radiations is the most energetic?
   a) Infra red light
   b) Visible light
   c) Ultraviolet light
   d) microwaves

7. Which of the following particles has the shortest de-Broglie wavelength, if all of them move with same speed?
   a) beta particle
   b) alpha particle
   c) proton
   d) neutron

Space for rough work

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8. The mass of a photon of wavelength λ is given by

   a) $h\lambda/c$

   b) λ/hc

   c) $h/\lambda c$

   d) hc/λ

9. The radius of a nucleus with A = 256 is 8 fermi (1 fermi = 1×10^{-15} m). The radius of a nucleus with A = 4 is

   a) 1 fermi

   b) 2 fermi

   c) 3 fermi

   d) 4 fermi

10. Photons of energy 6 eV fall on the surface of a metal with work function 4 eV. The stopping potential of the metal surface is

    a) 2 V

    b) 10 V

    c) 3 V

    d) 1 V

11. Addition of a minute quantity of phosphorus to a silicon crystal makes it

    a) an n-type semiconductor

    b) a bad conductor

    c) a good conductor

    d) a p-type semiconductor

12. The electric current in a circuit is given by $I = I_0 \sin(\omega t + \theta)$. What is the dimension of θ ?

    a) second

    b) 1/second

    c) meter / second

    d) dimensionless

13. The velocity varies with time according to the relation, $v = 3t + 4$. The distance travelled by the body in t = 2 s will be

    a) 10 m

    b) 12 m

    c) 14 m

    d) 16 m

14. When a projectile is at the highest point on its trajectory, the potential and kinetic energies are respectively

    a) maximum and minimum

    b) minimum and zero

    c) zero and maximum

    d) maximum and zero

15. A block of mass 2 kg starts moving when the angle of inclination of the inclined plane is 60°. If the coefficient of kinetic friction is 0.6, the frictional force is

    a) 2 N

    b) 1 N

    c) 4 N

    d) 0.5 N

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16. Two forces $F_1 = (7i + 2j)$ N and $F_2 = (-5i + 3j)$ N act on a particle. The third force F_3 that should act on the particle to make it move with constant velocity is

a) $(2i + 5j)$ N

b) $(-2i - 5j)$ N

c) $(-2i + 5j)$ N

d) $(2i - 5j)$ N

17. Two satellites of masses 3M and M orbit the earth in circular orbits of radii r and 3r respectively. The ratio of their speeds is

a) $1 : 1$

b) $\sqrt{3} : 1$

c) $3 : 1$

d) $9 : 1$

18. In an adiabatic process, the pressure of a gas is proportional to the cube of its absolute temperature. The value of γ (which equals C_p/C_v) is

a) 5/4

b) 4/3

c) 5/3

d) 3/2

19. A mass is moving towards the origin along the x-axis with constant velocity. Its angular momentum with respect to the origin

a) remains constant

b) is zero

c) increases

d) decreases

20. The rate of cooling of a liquid is $4°$ C/s, when its temperature is $80°$ C and is $2°$ C/s when its temperature is $50°$ C. The temperature of the surroundings is

a) $30°$ C

b) $20°$ C

c) $10°$ C

d) $25°$ C

21. A Charged sphere of radius 1m carries a charge of 1×10^{-9} C. The electric fields at a point P, which is at a distance $d = 3$m from the centre of the sphere and at a point Q, at a distance $d = 0.3$m from the centre of the sphere are respectively

a) 1 N/C and 100 N/C

b) 1 N/C and zero

c) zero and 1 N/C

d) 1 N/C and 3 N/C

22. An electric dipole lying along X-axis with moment 5 Am^2 is subjected to an electric field of magnitude 10j N/C. The torque experienced is

a) 2 Nm

b) 10 Nm

c) 50 Nm

d) 25 Nm

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23. A parallel plate capacitor with air gap of 5 mm is 2 MFD. If a metallic plate of thickness 3 mm is inserted in between the plates, the new capacitance is

    a) 5 MFD
    b) 1 MFD
    c) 2 MFD
    d) 2.5 MFD

24. A galvanometer of resistance 50 ohm gives a full scale deflection when 3 mA current passes through it. The series resistance that is to be connected to convert it into a voltmeter of range 0 – 3 V is

    a) 500 Ω
    b) 950 Ω
    c) 1000 Ω
    d) 750 Ω

25. Two resistances 6Ω and 3Ω are connected in parallel and this combination is connected in series with a 4Ω resistance. This combination is powered by a voltage source of 12 V and zero internal resistance. The ratio of power dissipated between 6Ω resistance and 4Ω resistance is

    a) 1:4
    b) 4:1
    c) 1:8
    d) 3:2

26. Two charged particles of charge ratio 1:4 moving with same velocity enter a region of uniform magnetic field of strength B and get deflected and move along curves with equal radius R. The ratio of their masses is

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

27. When a charged particle moves in a region with electric field E = 3i N/C and magnetic field B = 5j T, the trajectory of the particle is

    a) circle
    b) parabola
    c) straight line
    d) helix

28. Two co-axial coils A and B of radius R_1 and R_2 carry equal amount of current but flowing in opposite direction. The net magnetic field produced at the centre of these coils is zero. The ratio of the current flowing in the coil A to current in coil B is

    a) $R_1 : R_2$
    b) $R_2 : R_1$
    c) $(R_2 / R_1)^2$
    d) $(R_1 / R_2)^2$

29. Which among the following is a desirable feature of a ferromagnet that can be used as core of a transformer?

    a) high hysteresis loss and low retentivity

    b) low hysteresis loss and high retentivity

    c) high coercive field and high retentivity

    d) low hysteresis loss and low retentivity

30. The phase difference between the current through the resistance and voltage across the resistance in a series LCR circuit is

    a) 180°
    b) 0°
    c) 90°
    d) 45°