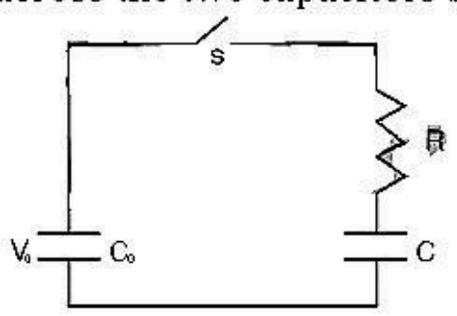
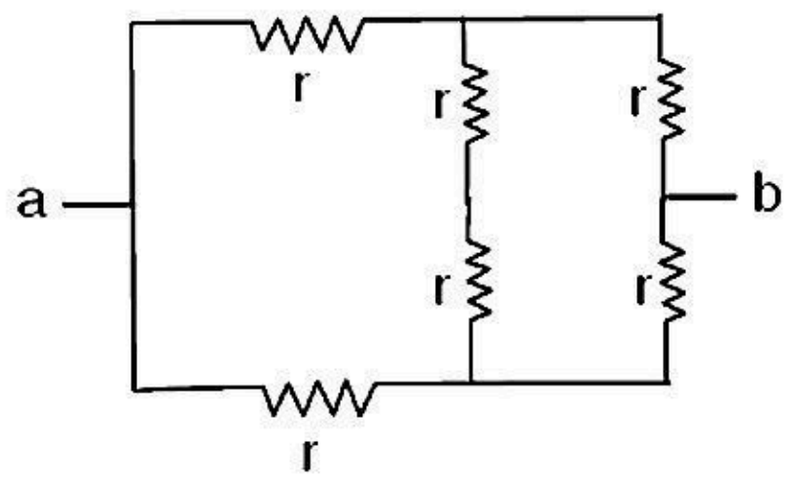
Physics- Set-5

1. Let C be the capacitance of a capacitor discharging through a resistor R. Suppose t_1 is the time taken for the energy stored in the capacitor to reduce to half its initial value and t_2 is the time taken for the charge to reduce to one-fourth its initial value. Then the ratio t_1/t_2 will be
   a) 1 b) ½ c) ¼ d) 2
2. The equation of state of a gas is given by $\left(P+\frac{a}{V^3}\right)(V-b^2)=cT$, where P, V, T are pressure, volume and temperature respectively, and a, b, c are constants. The dimensions of a and b are respectively
   a) ML^8T^{-2} *and* $L^{3}/_{2}$ b) ML^5T^{-2} *and* L^2 c) ML^5T^{-2} *and* L^6
   d) ML^6T^{-2} *and* $L^{3}/_{2}$
3. A capacitor of capacitance C_0 is charged to a potential V_0 and is connected with another capacitor of capacitance C as shown. After closing the switch S, the common potential across the two capacitors becomes V. The capacitance C is given by



   a) $\frac{C_o(V_o-V))}{V_o}$ b) $\frac{C_o(V-V_o))}{V_o}$ c) $\frac{C_o(V+V_o))}{V}$ d) $\frac{C_o(V_o-V))}{V}$
4. The r.m.s. speed of the molecules of a gas at 100°C is v. The temperature at which the r.m.s. speed will be $\sqrt{3}$v is
   a) 546°C b) 646°C c) 746°C d) 846°C
5. A frictionless piston-cylinder based enclosure contains some amount of gas at a pressure of 400 kPa. Then heat is transferred to the gas at constant pressure in a quasi-static process. The piston moves up slowly through a height of 10cm. If the piston has a cross-section area of 0.3 m^2, the work done by the gas in this process is
   a) 6 kJ b) 12 kJ c) 7.5 kJ d) 24 kJ
6. An electric cell of e.m.f. E is connected across a copper wire of diameter d and length l. The drift velocity of electrons in the wire is v_d if the length of the wire is changed to 2l, the new drift velocity of electrons in the copper wire will be
   a) v_d b) $2v_d$ c) $\frac{v_d}{2}$ d) $\frac{v_d}{4}$
7. A bar magnet has a magnetic moment of 200 $A.m^2$. The magnet is suspended in a magnetic field of 0.30 $NA^{-1}m^{-1}$. The torque required to rotate the magnet from its equilibrium position through an angle of 30°, will
   a) 30N m b) 30 $\sqrt{3}$N m c) 60 N m d)60 $\sqrt{3}$N m
8. An ideal mono-atomic gas of given mass is heated at constant pressure. In this process, the fraction of supplied heat energy used for the increase of the internal energy of the gas is
   a) 3/8 b) 3/5 c) 3/4 d) 2/5
9. The velocity of a car travelling on a straight road is 36 kmh^{-1} at an instant of time. Now travelling with uniform acceleration for 10 s, the velocity becomes exactly double. If the wheel radius of the car is 25 cm, then which of the following numbers is the closest to the number of revolutions that the wheel makes during this 10 s ?
   a) 84 b) 95 c) 126 d) 135

10. Two glass prisms $P_1$and P_2 are to be combined together to produce dispersion without deviation. The angles of the prisms P_1 and P_2 are selected as 4° and 3° respectively. If the refractive index of prism P_1 is 1.54, then that of P_2 will be
    a) 1.48 b) 1.58 c) 1.62 d) 1.72
11. The ionization energy of the hydrogen atom is 13.6 eV. The potential energy of the electron in n = 2 state of hydrogen atom is
    a) + 3.4 eV b) – 3.4 eV c) + 6.8 eV d) – 6.8 eV
12. A wire of initial length L and radius r is stretched by a length l. Another wire of same material but with initial length 2L and radius 2r is stretched by a length 2l. The ratio of the stored elastic energy per unit volume in the first and second wire is
    a) 1 : 4 b) 1 : 2 c) 2 : 1 d) 1 : 1
13. Two spheres of the same material, but of radii R and 3R are allowed to fall vertically downwards through a liquid of density σ. The ratio of their terminal velocities is
    a) 1 : 3 b) 1 : 6 c) 1 : 9 d) 1 : 1
14. An alpha particle (^{4}He) has a mass of 4.00300 amu. A proton has mass of 1.00783 amu and a neutron has mass of 1.00867 amu respectively. The binding energy of alpha particle estimated from these data is the closest to
    a) 27.9 MeV b) 22.3 MeV c) 35.0 MeV d) 20.4 MeV
15. Four small objects each of mass m are fixed at the corners of a rectangular wire-frame of negligible mass and of sides 'a' and 'b' (a > b). If the wire frame is now rotated about an axis passing along the side of length b, then the moment of inertia of the system for this axis of rotation is
    a) $2ma^2$ b) $4ma^2$ c) $2m(a^2+ b^2)$ d) $2m(a^2– b^2)$
16. The equivalent resistance between the points a and b of the electrical network shown in the figure is



    a) 6 r b) 4 r c) 2r d) r
17. The de Broglie wavelength of an electron (mass = 1×10^{-30}kg, charge = 1.6×10^{-19}C) with a kinetic energy of 200 eV is (Planck's constant = 6.6×10^{-34} J s)
    a) 9.60×10^{-11}m b) 8.25×10^{-11}m c) 6.25×10^{-11}m d) 5.00×10^{-11}m
18. An object placed at a distance of 16 cm from a convex lens produces an image of magnification m (m > 1). If the object is moved towards the lens by 8 cm then again an image of magnification m is obtained. The numerical value of the focal length of the lens is
    a) 12 cm b) 14 cm c) 18 cm d) 20 cm
19. The number of atoms of a radioactive substance of half-life T is N0 at t = 0. The time necessary to decay from $N_0/2$ atoms to $N_0/10$ atoms will be
    a) $\frac{5}{2}T$ b) $T \ln 5$ c) $T \ln \frac{5}{2}$ d) $T \frac{\ln 5}{\ln 2}$

20. A travelling acoustic wave of frequency 500 Hz is moving along the positive x-direction with a velocity of 300 ms^{-1}. The phase difference between two points x_1 and x_2 is 60º. Then the minimum separation between the two points is

a) 1 mm b) 1 cm c) 10 cm d) 1 m