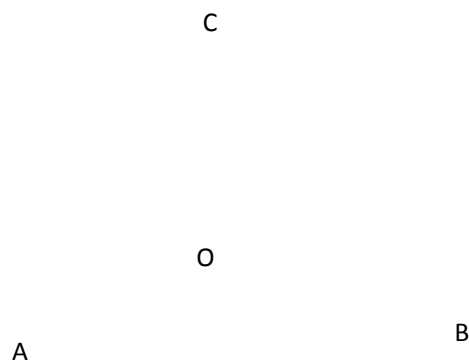# Physics

1. (a) Define angular velocity and angular acceleration.
   (b) Why are circular roads banked ? Deduce an expression for the angle of banking.
   (c) A 1000 kg car rounds a curve on a flat road of radius 50 m at a speed of 50 km/hr (14 m/s). Will the car make the turn or will it skid if the coefficient of friction is 0.60? Justify.

2. (a) What are stationary waves ? Deduce the equation for a stationary wave.
   (b) If the successive overtones of a vibrating string are 20 Hz and 350 Hz. What is the frequency of the fundamental?
   (c) If the amplitude of a sound wave is tripled, by how many dB will the intensity level increase ?

3. (a) Write down Vander Waall's equation of static for a gas.
   (b) Show that as the volume per mole of oxygen molecules, calculate the diameter of an oxygen molecule.

4. (a) Draw the electric field lines surrounding two negative electric charges a distance d apart.
   (b) How many electrons make up a charge 20µC ?
   (c) Two point charges q_1(= + 2.0 x 10^{-7} Coul). and q_2(= + 8.0 x 10^{-8} Coul) 12 cms apart. At what point on the line joining the two charges is the electric field strength zero?

5. (a) Explain how a galvanometer can be converted into (i) an ammeter (ii) a voltmeter.
   (b) Six resistors of 8 ohms each are connected as shown in the figure below. Find the effective resistance between A and C

C

O

B

A

   (c) If a galvanometer of resistance G is shunted by a resistance S, what is the fraction of the total current flowing through the galvanometer ?

6. (a) What is a magnetic dipole ?

(b) Describe how M and H can be separately determined from experiment.

(c) A freely suspended magnet oscillates with period T is earth's horizontal field. When a bar magnet is brought near it, the period decreases to T/2 . What is the ratio of the field of the magnet (F) and the earth's horizontal field (H)?

7. (a) Show that the power per unit volume P transformed into Joule near in a resistor can be written as $P = E^2/\rho$ where ρ is resistivity of the material and E the intensity of electric field.

    (b) A heater wire of length 20 ft and resistance 24 ohms is cut into two and wound into two separate coils. By what factor is the power increased in each coil is connected across a 220 volt line?

    (c) Does the relation V = IR apply to non-ohmic resistors ?

8. (a) Explain the principle of the telescope.

    (b) How is the telescope different from a microscope ?

    (c) A convex mirror has a radius of curvature of 20 cm. If a point source is placed 14 cm away from the mirror, where is the image?

9. (a) Derive the radioactive decay law.

    (b) Define the disintegration energy of a decay.

    (c) Half life of a radium is 1600 years. If the mass at the beginning is 1 kg, what is the amount of radium after 4800 years?

10. (a) How are X-rays produced ?

    (b) State Bragg's law.

    (c) What is the maximum wavelength of X-rays which a crystal of spacing d=2.5 A^0 can diffract ?