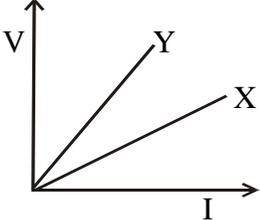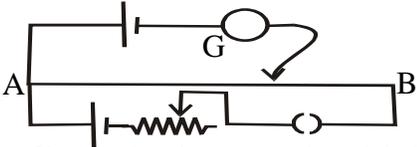1. A spherical shell of radius R has a surface charge density s.
   (a) State the theorem which can be used to find electric field outside the shell.
   (b) Using the theorem, arrive at an expression for electric field at a distance r from the centre of the shell.
   (c) It is safe to be inside a vehicle rather than outside, even when there is lightning and thunder. Comment.
   (d) A spherical shell of radius 12 cm has a charge of 1×10^{-7} C distributed uniformly on its surface.
      What is the electric field at a point 18 cm from the centre of the sphere? $\{1 + 2 + 2 + 2 = 7\}$

2. The V-I graph of two conductors are given below.
   (a) Which one has greater resistance?
   (b) Deduce Ohm's law and hence find what are the
      factors affecting resistance of a conductor?
   (c) Use your equation to explain that resistivity of a
      material is a constant for the material at given temperature.
   (d) A wire of resistance 10 W and resistivity r stretched to double its original length. Find new resistivity
      and resistance. $\{1 + 2 + 2 + 2 = 7\}$

OR

2. A potentiometer circuit is as shown.
   (a) What is the principle of potentiometer?
   (b) Complete the diagram for the measurement of internal resistance and explain how internal resistance
      is measured by using potentiometer.
   (c) Why is potentiometer preferred to voltmeter in measuring emf of a cell. $\{2 + 3 + 2 = 7\}$

3. Cyclotron is a device used for accelerating charged particles.
   (a) Give the working principle of a cyclotron.
   (b) Obtain the expression for cyclotron frequency.
   (c) Neutrons cannot be accelerated using cyclotron. Why? $\{1 + 2 + 1 = 4\}$

4. A solenoid consists of n number of turns per unit length, carrying a current I.
   (a) Find the magnetic field produced by solenoid along its axis using Ampere's circuital law.
   (b) What happens to the magnetic field produced by solenoid when a soft iron core is placed inside it.
          $\{2 + 1 = 3\}$

5. Two cups A and B are placed on an induction cooker. Cup A is made of metal and cup B is of glass.
   (a) In which of these cups will water boil?
   (b) Name the principle behind it?
   (c) Mention other applications of this principle. $\{½ + 1 + 2 = 3½\}$

6. In an ac circuit, we come cross the terms reactance and impedence.
   (a) What is inductive reactance?
   (b) What is the expression for impedance in LCR circuit.
   (c) What do you mean by resonant frequency of an LCR circuit. $\{2 + 1 + 1½ = 3½\}$

7. Name the electromagnetic waves used for the following.
   (a) Detection of fracture in bones.
   (b) Detection of invisible writings, finger prints.
   (c) Radiation therapy in cancer.
   (d) Purification of drinking water. $\{½ \times 4 = 2\}$

8. A ray of light passes from denser to rarer medium.
   (a) What happens to the refracted ray as the angle of incidence increases from 0°?
   (b) What is the importance of critical angle?
   (c) How is 'C' related to refractive index? $\{1 + 1 + 1 = 3\}$

9. While doing an experiment to find focal length of a convex lens in laboratory, the lens fell down from
   Anoop's hand and became two pieces.
   (a) Can he continue his experiment with the piece? If no, give reason and if yes, how will be the image?

(b) a magician during a show makes a glass lens n = 1.5 disappear in a trough of liquid. What is the refractive index of the liquid?   {1 + 1 = 2 }

10. Two narrow slits are illuminated by a single monochromatic source.
   (a) Name the pattern obtained on the screen.
   (b) Derive the expression for bandwidth of above pattern.
   (c) One of the slits is now completely covered. What is your observation?   { 1 + 2 + 1 = 4 }

                OR

10. Microscope is an optical instrument used for magnifying small and near objects.
   (a) What is the principle of a simple microscope?
   (b) Draw ray diagram for compound microscope?
   (c) Write any one difference between microscope and telescope.   {1 + 2 + 1 = 4 }

11. de Broglie suggested that matter also possess dual nature like radiations. Einstein's photon picture depicts the dual nature of radiations.
   (a) What is the meaning of matter wave?
   (b) Calculate the de Broglie wavelength of a body of mass 2 kg moving with a velocity 10 m/s. {1 + 2 = 3}

12. Rutherford atom model failed to explain stability of atom.
   (a) Do you agree with this statement?
   (b) Justify your answer.   {½ + 1½ = 2}

13. You are given two nuclides $_3X^7$ and $_3X^4$
   (a) Are they isotopes?
   (b) Which one of the two is likely to be more stable?
   (c) Give reason for its stability.   {½ + 1½ + 1½ = 3}

14. In the circuits shown below, a switch which is opened represents the logic state 0 and the switch which is closed represents the logic state 1. The lamp L is lit when the output is logic state 1. What types of gates are represented by the circuit shown in fig a and fig b.   {3}
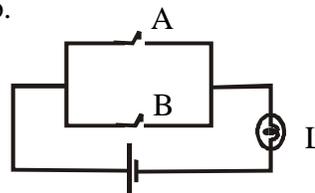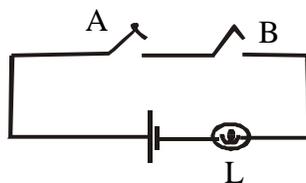
15. When a forward bias is applied to a PN junction, it
   (a) Raises the potential barrier.
   (b) Reduces majority carrier current to zero.
   (c) Lower the potential barrier.
   (d) None of the above.   {1}

16. Rectification is the process of converting ac into dc using diode.
   (a) Draw the circuit diagram of half wave rectifier.
   (b) Explain the working of a half wave rectifier.   {1 + 2 = 3 }

17. A carrier wave is an electromagnetic wave of high frequency and of constant amplitude which is employed to carry the signals after getting modulated.
   (a) Why high frequency carrier waves are employed for transmission.
   (b) What is amplitude modulation and what are its advantages?
   (c) A TV tower has a height of 80 m. Find the radius of the circle within which the transmission can be observed if the radius of earth is 6.4 x 10^6 m.   {1 + 2 + 3 = 6}