CASE STUDY QUESTION 01

Read the following and answer any four questions from (i) to (v)

All living cells require energy for various activities. This energy is available by the breakdown of simple carbohydrates either using oxygen or without using oxygen.

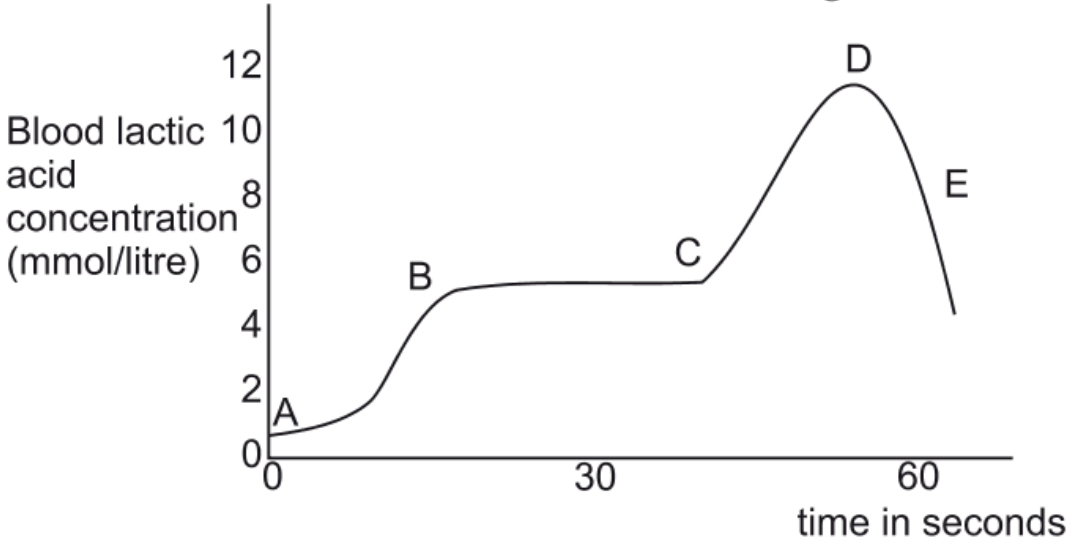
(i) Energy in the case of higher plants and animals is obtained by
(a) Breathing
(b) Tissue respiration
(c) Organ respiration
(d) Digestion of food

Tissue respiration is the process by which living cells absorb oxygen and release carbon dioxide. It is Internal respiration occurs in animals with a circulation system.

(ii) The graph below represents the blood lactic acid concentration of an athlete during a race of 400 m and shows a peak at point D.

Respiration in atheletics:

The blood of an athlete was tested before, during and after a 400 m race.



Lactic acid production has occurred in the athlete while running in the 400 m race. Which of the following processes explains this event?

(a) Aerobic respiration (b) Anaerobic respiration

(c) Fermentation (d) Breathing

Which of the following processes explains this event?

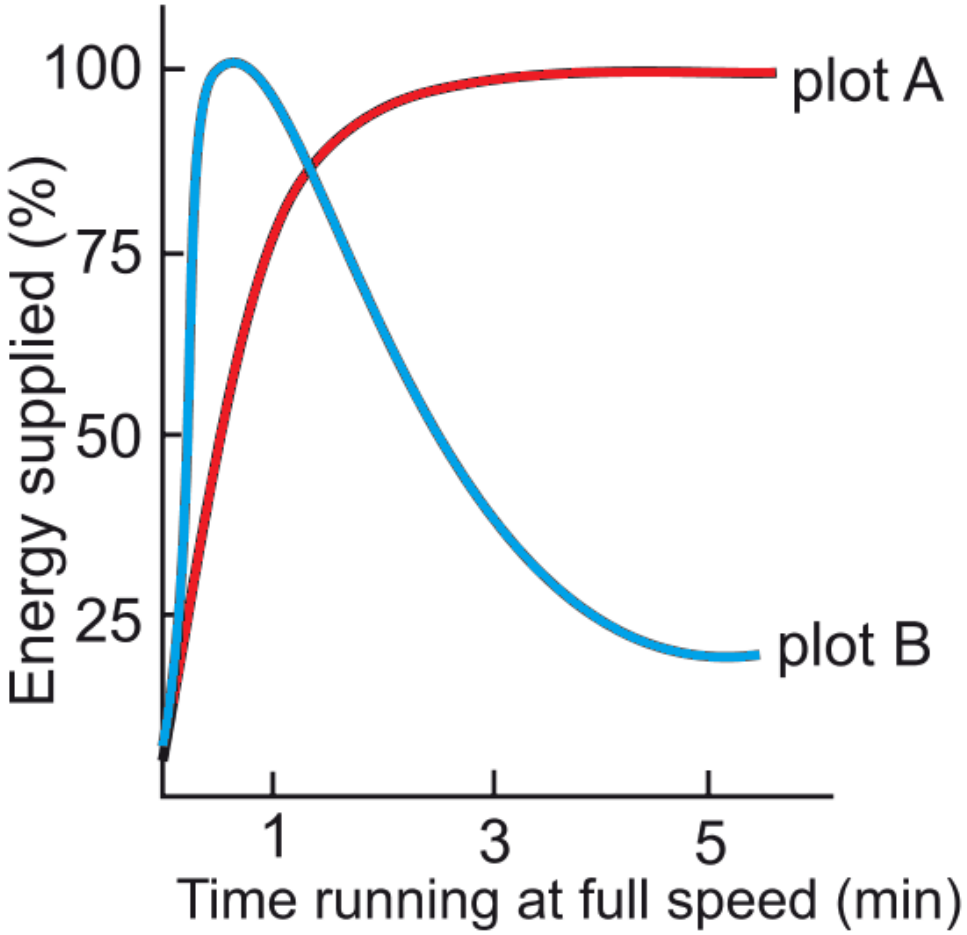
(a) Aerobic respiration (b) Anaerobic respiration

(c) Fermentation (d) Breathing

Anaerobic means “without air”. Therefore, this type of cellular respiration does not use oxygen to produce energy.

During heavy or intensive exercise such as running, sprinting, cycling or weight lifting, our body demands high energy. As the supply of oxygen is limited, the muscle cells inside our body resort to anaerobic respiration to fulfil the energy demand.

(iii) Study the graph below that represents the amount of energy supplied with respect to the time while an athlete is running at full speed.



Choose the correct combination of plots and justification provided in the following table.

	Plot A	Plot B	Justification
(a)	Aerobic	Anaerobic	Amount of energy is low and inconsistent in aerobic and high in anaerobic.
(b)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic.
(c)	Anaerobic	Aerobic	Amount of energy is high and consistent in aerobic and low in anaerobic.
(d)	Anaerobic	Aerobic	Amount of energy is high and inconsistent in anaerobic and low in aerobic.

(b)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic

(iv) The characteristic processes observed in anaerobic respiration are
i) presence of oxygen
ii) release of carbon dioxide
iii) release of energy
iv) release of lactic acid

(a) i) ,ii) only
(b) i), ii), iii) only
(c) ii), iii), iv) only
(d) iv) only

Ans. (c) ii), iii), iv) only

(v) Study the table below and select the row that has the incorrect information.

		Aerobic	Anaerobic
(a)	Location	Cytoplasm	Mitochondria
(b)	End Product	CO_2 and H_2O	Ethanol and CO_2
(c)	Amount of ATP	High	Low
(d)	Oxygen	Needed	Not needed

Aerobic Respiration can be found in the cytoplasm and the mitochondria.
Anaerobic Respiration can be found only in the cytoplasm.

CASE STUDY QUESTION 02

Read the following and answer any four questions from (i) to (v)

Metallic Character

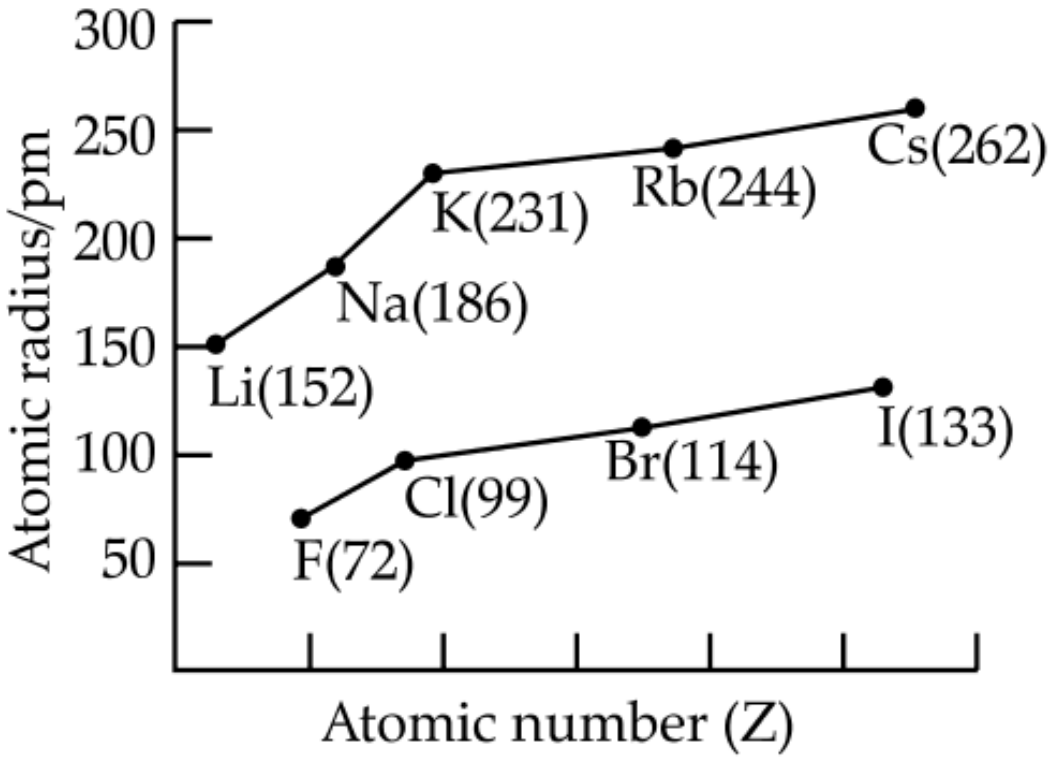
The ability of an atom to donate electrons and form positive ion (cation) is known as electropositivity or metallic character. Down the group, metallic character increases due to increase in atomic size and across the period, from left to right electropositivity decreases due to decrease in atomic size.

Non-Metallic Character

The ability of an atom to accept electrons to form a negative ion (anion) is called non-metallic character or electronegativity. The elements having high electro-negativity have a higher tendency to gain electrons and form anion. Down the group, electronegativity decreases due to increase in atomic size and across the period, from left to right electronegativity increases due to decrease in atomic size.

(i) Which of the following correctly represents the decreasing order of metallic character of Alkali metals plotted in the graph?

(a) Cs > Rb > Li > Na > K
(b) K > Rb > Li > Na > Cs
(c) Cs > Rb > K > Na > Li
(d) Cs > K > Rb > Na > Li



As we move down the group atomic radius increases so the metallic character also increases.
Hence the order is Li < Na < K < Rb < Cs.

(ii) Hydrogen is placed along with Alkali metals in the modern periodic table though it shows non-metallic character

(a) as Hydrogen has one electron & readily loses electron to form negative ion

(b) as Hydrogen can easily lose one electron like alkali metals to form positive ion

(c) as Hydrogen can gain one electron easily like Halogens to form negative ion

(d) as Hydrogen shows the properties of non-metals

(b) as Hydrogen can easily lose one electron like alkali metals to form positive ion

(iii) Which of the following has highest electronegativity?

(a) F (b) Cl (c) Br (d) I

Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases

(iv) Identify the reason for the gradual change in electronegativity in halogens down the group.

(a) Electronegativity increases down the group due to decrease in atomic size

(b) Electronegativity decreases down the group due to decrease in tendency to lose electrons

(c) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases

(d) Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons

(v) Which of the following reason correctly justifies that “Fluorine (72pm) has smaller atomic radius than Lithium (152pm)”?

(a) F and Li are in the same group. Atomic size increases down the group
(b) F and Li are in the same period. Atomic size increases across the period due to increase in number of shells
(c) F and Li are in the same group. Atomic size decreases down the group
(d) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

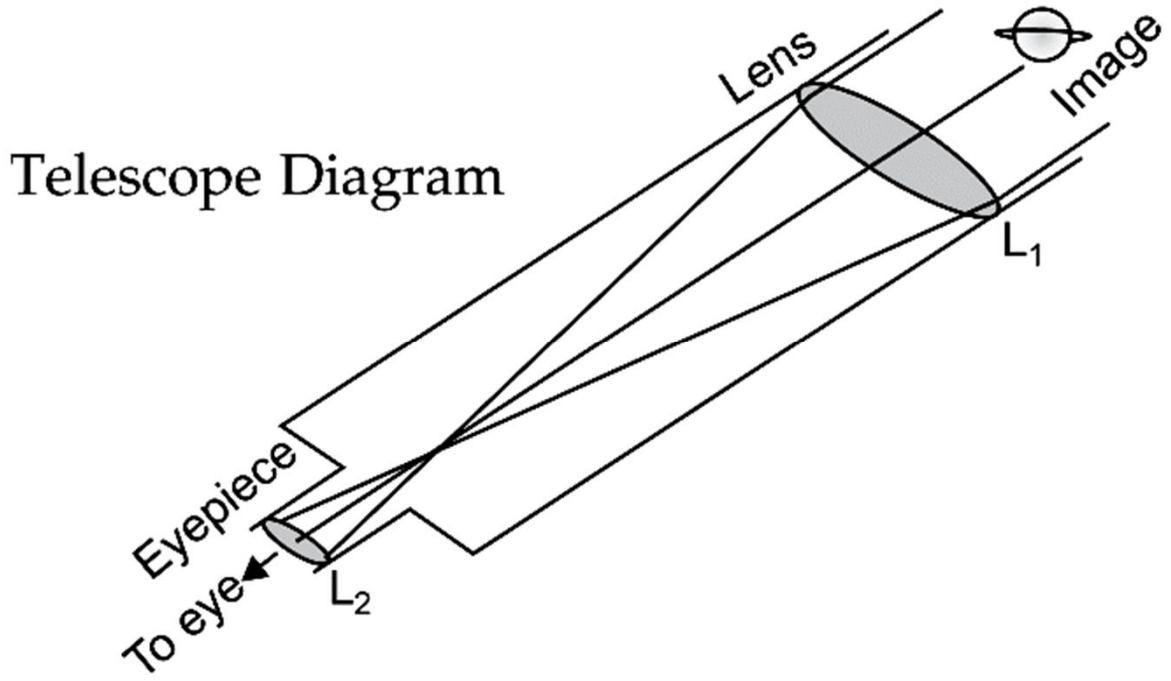
(d) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

CASE STUDY QUESTION 03

Read the following and answer any four questions from (i) to (v)

Sumati wanted to see the stars of the night sky. She knows that she needs a telescope to see those distant stars. She finds out that the telescopes, which are made of lenses, are called refracting telescopes and the ones which are made of mirrors are called reflecting telescopes.

So she decided to make a refracting telescope. She bought two lenses, L_1 and L_2, out of which L_1 was bigger and L_2 was smaller. The larger lens gathers and bends the light, while the smaller lens magnifies the image. Big, thick lenses are more powerful. So to see far away, she needed a big powerful lens. Unfortunately, she realized that a big lens is very heavy. Heavy lenses are hard to make and difficult to hold in the right place. Also since the light is passing through the lens, the surface of the lens has to be extremely smooth. Any flaws in the lens will change the image. It would be like looking through a dirty window.



(i) Based on the diagram shown, what kind of lenses would Sumati need to make the telescope?

(a) Concave lenses (b) Convex lenses (c) Bifocal lenses (d) Flat lenses

Ans: (b) Convex lenses

(ii) If the powers of the lenses L_1 and L_2 are in the ratio of 4:1, what would be the ratio of the focal length of L_1 and L_2?

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

$$P_1 = \frac{1}{f_1} \text{ and } P_2 = \frac{1}{f_2}$$

$$\text{Given } \frac{P_1}{P_2} = \frac{4}{1}$$

$$\text{So, } \frac{\frac{1}{f_1}}{\frac{1}{f_2}} = \frac{4}{1} \qquad \text{Hence, } \frac{f_1}{f_2} = \frac{1}{4} \text{ or } 1:4$$

(iii) What is the formula for magnification obtained with a lens?
(a) Ratio of height of image to height of object
(b) Double the focal length.
(c) Inverse of the radius of curvature.
(d) Inverse of the object distance.

$$\text{Magnification } (m) = \frac{h'}{h} = \frac{v}{u}$$

(a) Ratio of height of image to height of object

(iv) Sumati did some preliminary experiment with the lenses and found out that the magnification of the eyepiece (L_2) is 3. If in her experiment with L_2 she found an image at 24 cm from the lens, at what distance did she put the object?

(a) 72 cm (b) 12 cm (c) 8 cm (d) 6 cm

Given $m = 3,\ v = 24,\ u = ?$

We know, $m = \frac{v}{u}$

$\Rightarrow \quad 3 = \frac{24}{u}$

Hence, $u = 8$ cm

(v) Sumati bought not-so-thick lenses for the telescope and polished them. What advantages, if any, would she have with her choice of lenses?

(a) She will not have any advantage as even thicker lenses would give clearer images.
(b) Thicker lenses would have made the telescope easier to handle.
(c) Not-so-thick lenses would not make the telescope very heavy and also allow considerable amount of light to pass.
(d) Not-so-thick lenses will give her more magnification.

(c) Not-so-thick lenses would not make the telescope very heavy and also allow considerable amount of light to pass.

CASE STUDY QUESTION 04

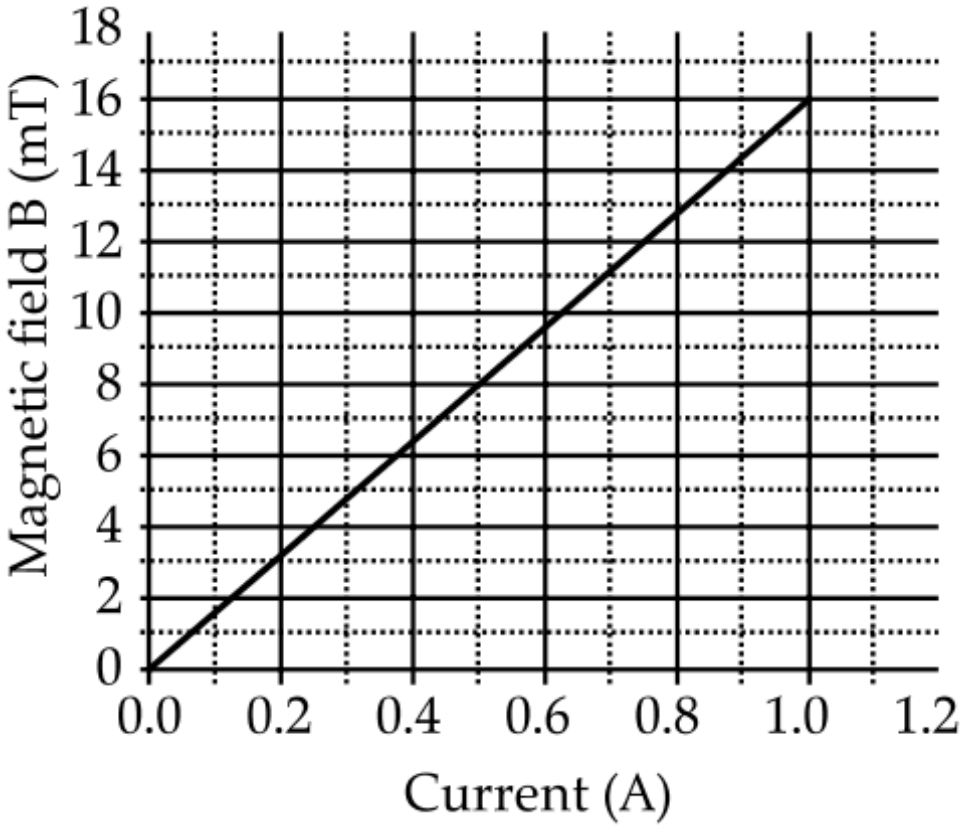
Read the following and answer any four questions from (i) to (v)

A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.

The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid. The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.

(i) What type of energy conversion is observed in a linear solenoid?

(a) Mechanical to Magnetic
(b) Electrical to Magnetic
(c) Electrical to Mechanical
(d) Magnetic to Mechanical



A “Linear Solenoid” is an electromagnetic device that converts electrical energy into a mechanical pushing or pulling force or motion.

Ans: (c) Electrical to Mechanical

(ii) What will happen if a soft iron bar is placed inside the solenoid?

(a) The bar will be electrocuted resulting in short-circuit.

(b) The bar will be magnetised as long as there is current in the circuit.

(c) The bar will be magnetised permanently.

(d) The bar will not be affected by any means.

The magnetic field around a current carrying solenoid is similar to the magnetic field produced by a bar magnet.

When a soft iron bar is introduced inside a current carrying solenoid, the magnetic field inside the solenoid will increase.

Ans: (b) The bar will be magnetised as long as there is current in the circuit.

(iii) The magnetic field lines produced inside the solenoid are similar to that of …

(a) a bar magnet

(b) a straight current carrying conductor

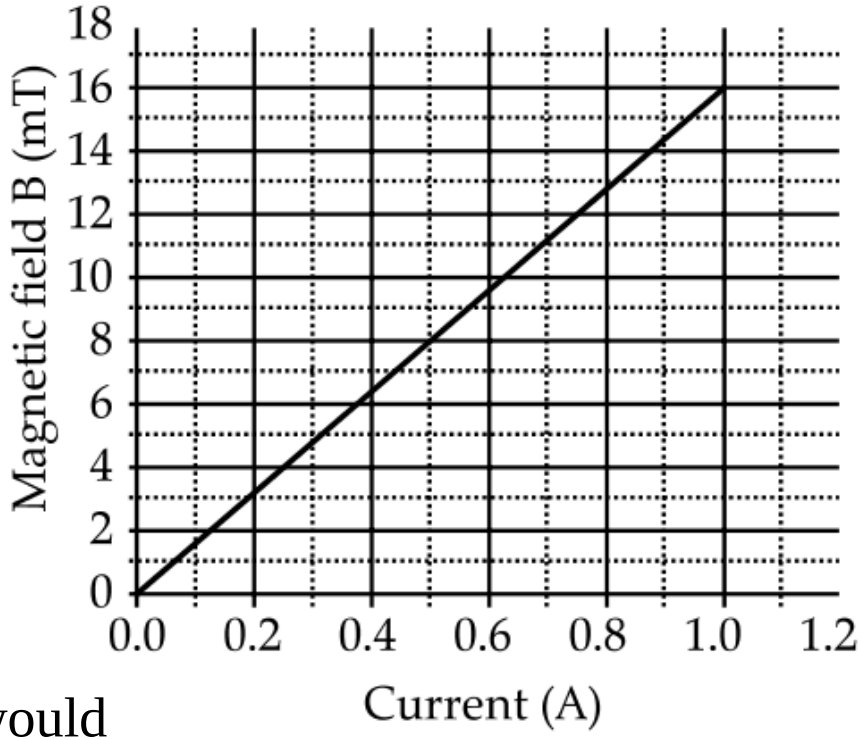
(c) a circular current carrying loop

(d) electromagnet of any shape

Ans: (a) a bar magnet

(iv) After analysing the graph a student writes the following statements.

I. The magnetic field produced by the solenoid is inversely proportional to the current.
II. The magnetic field produced by the solenoid is directly proportional to the current.
III. The magnetic field produced by the solenoid is directly proportional to square of the current.
IV. The magnetic field produced by the solenoid is independent of the current.



Choose from the following which of the following would be the correct statement(s).

(a) Only IV (b) I and III and IV
(c) I and II (d) Only II

Ans: (d) Only II

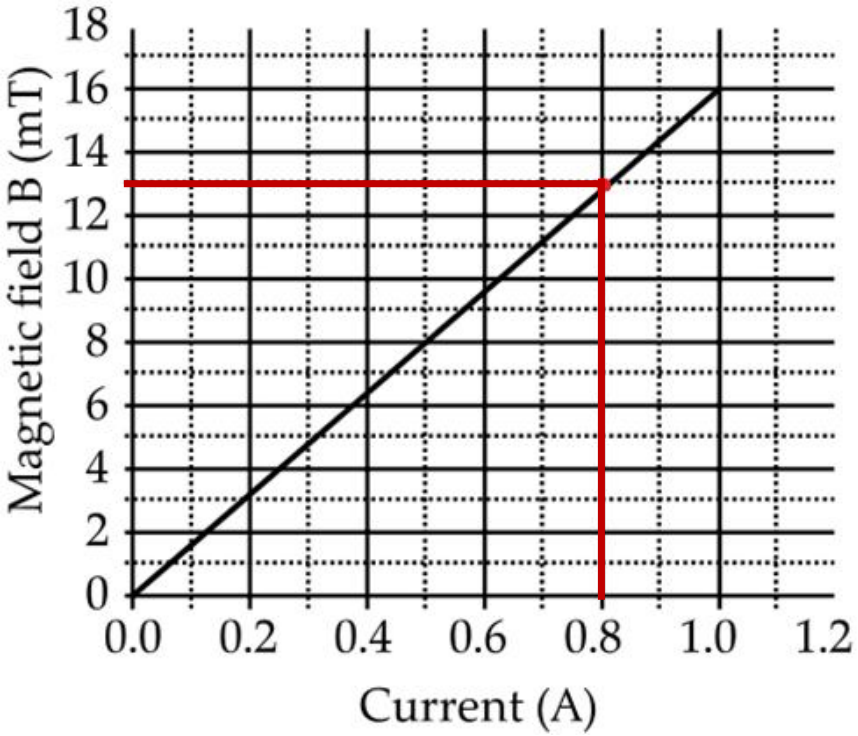
(v) From the graph deduce which of the following statements is correct.

(a) For a current of 0.8A the magnetic field is 13 mT

(b) For larger currents, the magnetic field increases non-linearly.

(c) For a current of 0.8A the magnetic field is 1.3 mT

(d) There is not enough information to find the magnetic field corresponding to 0.8A current.

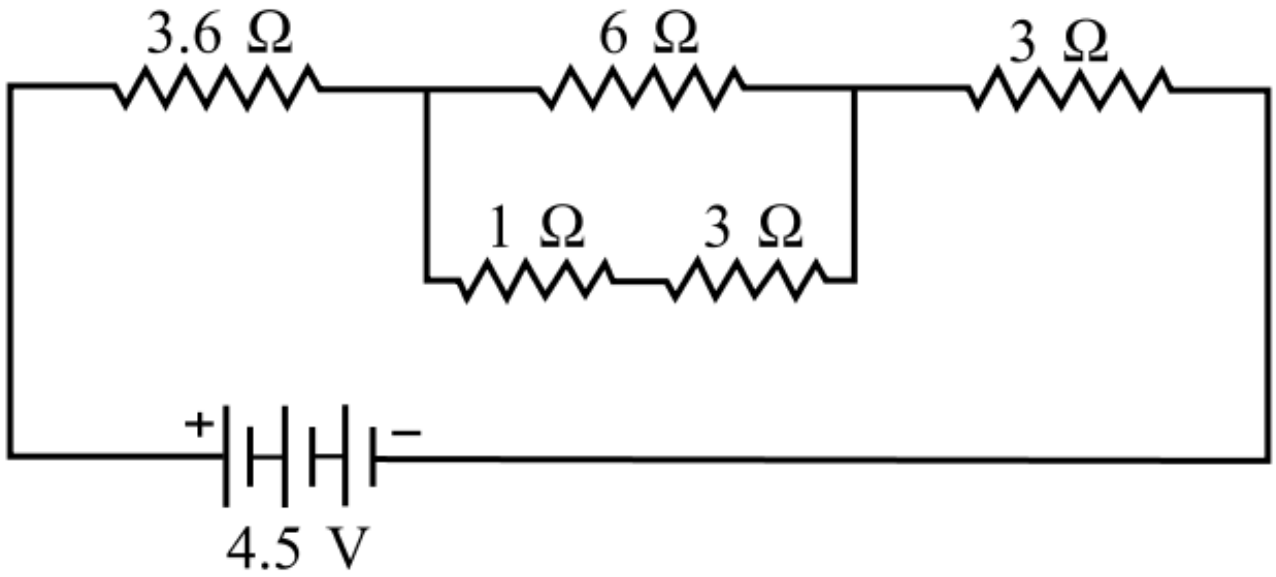


(a) For a current of 0.8A the magnetic field is 13 mT

CASE STUDY QUESTION 05

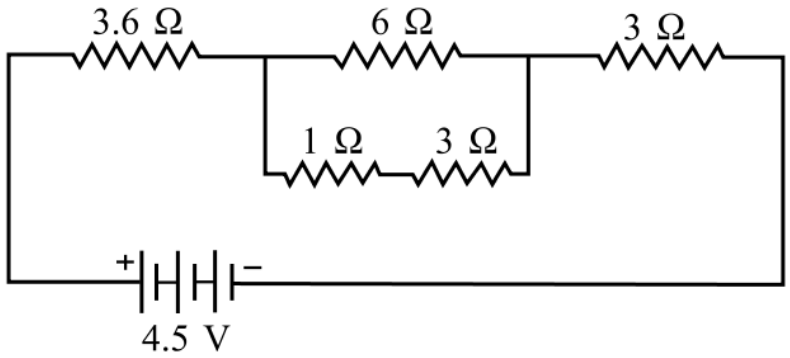
Read the following and answer any four questions from (i) to (v)

Shyam made one circuit for his Physics. He used five resistances: two 3Ω, one 1Ω, one 6Ω, one 3.6 Ω and a battery of 4.5 V. The circuit diagram is given below:



(i) Total resistance of parallel combination is :

(a) 2.4 Ω (b) 3 Ω (c) 6 Ω (d) 2 Ω



1 Ω and 3 Ω are in series.

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{1+3} = \frac{1}{6} + \frac{1}{4} = \frac{5}{12}$$

$$\Rightarrow R = \frac{12}{5} = 2.4\ \Omega$$

(ii) Equivalent resistance of total circuit is :

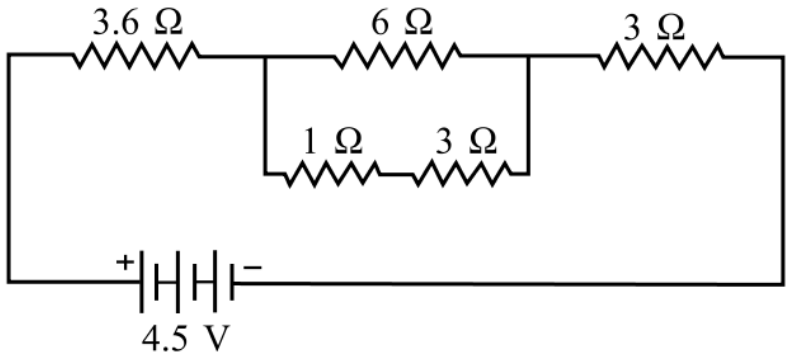
(a) 5 Ω (b) 9 Ω (c) 11 Ω (d) 13 Ω

$$R_1 = R + 3.6 + 3$$

$$= 2.4 + 3.6 + 3 = 9\ \Omega$$

(iii) Total current in the circuit is :

(a) 2 A (b) 4.5 A (c) 0.5 A (d) 10 A



$$I = \frac{V}{R_1} = \frac{4.5\ V}{9\ \Omega}$$

$$= 0.5\ A$$

(iv) Current in 6 ohm resistance is

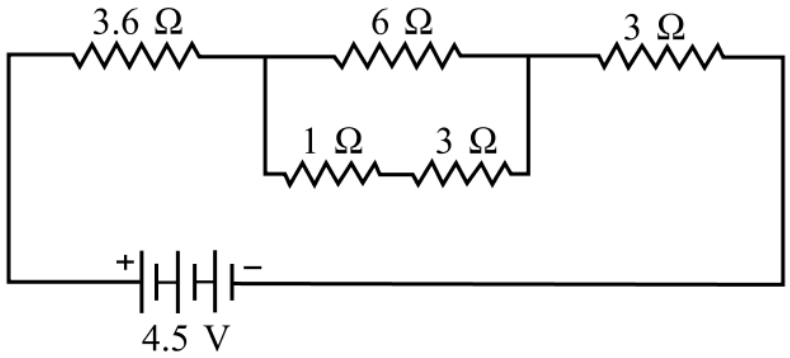
(a) 0.3 A (b) 0.2 A (c) 4 A (d) 6 A

$$V = IR_l = 0.5 \times 2.4 = 1.2\ \text{V}$$

$$\therefore\ \text{I}_1 = \frac{1.2\ V}{6\ \Omega} = 0.2\ \text{A}$$

(v) Potential across 3.6 ohm resistance will be :

(a) 1.8 V (b) 2.6 V (c) 9 V (d) 4.5V



$$V_1 = \mathrm{I} \times 3.6\,\Omega$$

$$= 0.5\ \mathrm{A} \times 3.6\,\Omega$$

$$= 1.8\ \mathrm{V}$$