Mathematics, Chemistry, Physics

(Set-C question No. 49) (Set-A question No. 4)

4. A cube of side 4 cm cut into small cubes of each side 1 cm. The ratio of the surface area of all smaller cubes to that of large one is

A) 1 : 2

B) 1 : 4

C) 4 : 1

D) 2 : 1

Initial Answer Key: C

Final Answer Key:

Solution :

4) Area of each face $= 4^2 = 16$

No. of faces $= 6$

Total area $= 16 \times 6 = 96$

Area of each small face $= 6 \times 1^2 = 6$

No. of pieces $= 64$

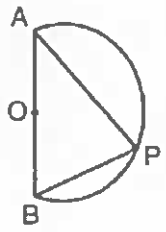
∴ Total area $= 64 \times 6 = 384$

∴ ratio is $384 : 96 = 4 : 1$

Photo Proof:

(Set-A)

19. In the figure, a semicircle with centre O is drawn on AB = 8 cm. If $\angle ABP = 60°$ then the area of ΔABP is



A) $\frac{\sqrt{3}}{8}$ cm

B) 8 cm

C) $8\sqrt{3}$ cm

D) $4\sqrt{3}$ cm

Initial Answer Key: D

Final Answer Key: C

Solution :

19) $\text{Area} = \frac{1}{2} BP \times AP$

$= \frac{1}{2} (AB \cos 60°)(AB \sin 60°)$

$= \frac{1}{2} (AB)^2 \left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$

$= \frac{1}{2} (8)^2 \left(\frac{\sqrt{3}}{4}\right)$

$= \frac{1}{\cancel{8}_1} \times \cancel{64}^{8} \sqrt{3}$

$= 8\sqrt{3}$

Photo Proof:

20. The top of a partially broken tree touches the ground at a point 10 m from the foot of it and makes an angle of elevation of 30° from the ground. The height of the tree is

A) $\frac{10}{\sqrt{3}}$ m

B) $10\sqrt{3}$ m

C) $\frac{\sqrt{3}}{10}$ m

D) $\sqrt{3}$ m

Initial Answer Key: A

Final Answer Key:

Solution :

20) $\tan 30^\circ = \frac{R}{10} \Rightarrow R = 10 \tan 30^\circ$

$= 10\left(\frac{1}{\sqrt{3}}\right)$

$= \frac{10}{\sqrt{3}}$

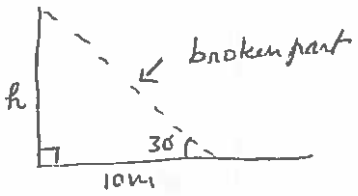


Photo Proof:

(Set-A)

24. If $\tan\theta = \frac{-4}{3}$ then the value of $\sin\theta$ is

A) $\frac{4}{15}$

B) $\pm\frac{4}{5}$

C) $\frac{-4}{5}$ but not $\frac{4}{5}$

D) $\frac{4}{5}$ but not $\frac{-4}{5}$

Initial Answer Key: B

Final Answer Key:

Solution :

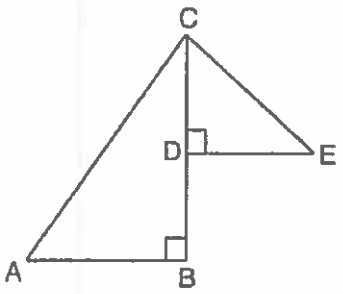
24) $\tan\theta = -\frac{4}{3} \Rightarrow \theta$ is in II quadrant or IV quadrant

$\therefore \sin\theta = \pm\frac{4}{5}$

Photo Proof:

(Set-D question No. 45) (Set-A question No. 30)

30. In the figure, Δ ABC and Δ CDE are right angled triangles. If AC = 24 cm, CE = 7 cm and $\angle ACB = \angle CED$ then AE is



A) 30 cm
B) 25 cm
C) 22 cm
D) 15 cm

Initial Answer Key: B

Final Answer Key:

Solution :

30) $AC^2 + CE^2 = AE^2 \Rightarrow 24^2 + 7^2 = 25^2$

$\therefore AE = 25$

Photo Proof:

(Set-A)

32. The reflection of the point (–3, –2) in Y axis is

A) (3, –2)

B) (–3, 2)

C) (3, 2)

D) (0, –2)

Initial Answer Key: A

Final Answer Key:

Solution :

32) (3, –2)

Photo Proof:

(Set-B question No. 48) (Set-A question No. 33)

33. A rational number between $\frac{5}{7}$ and $\frac{9}{11}$ is

A) $\frac{59}{77}$

B) $\frac{31}{77}$

C) $\frac{23}{11}$

D) $\frac{7}{9}$

Initial Answer Key: A

Final Answer Key:

Solution :

33) $\frac{\frac{5}{7}+\frac{9}{11}}{2} = \frac{59}{77}$

Photo Proof:

(Set-B question No. 21) (Set-A question No. 36)

36. The simplest form of

$\left(x^2+\frac{1}{x^2}\right)\left(x+\frac{1}{x}\right)\left(x^4+\frac{1}{x^4}\right)\left(x-\frac{1}{x}\right)$ is

A) 1

B) $x^8-\frac{1}{x^8}$

C) $x^8+\frac{1}{x^8}$

D) $x^{16}-\frac{1}{x^{16}}$

Initial Answer Key: B

Final Answer Key:

Solution :

36) $\left(x^2+\frac{1}{x^2}\right)\left(x+\frac{1}{x}\right)\left(x^4+\frac{1}{x^4}\right)\left(x-\frac{1}{x}\right)$

$=\left(x+\frac{1}{x}\right)\left(x-\frac{1}{x}\right)\left(x^2+\frac{1}{x^2}\right)\left(x^4+\frac{1}{x^4}\right)$

$=\left(x^2-\frac{1}{x^2}\right)\left(x^2+\frac{1}{x^2}\right)\left(x^4+\frac{1}{x^4}\right)$

$=\left(x^4-\frac{1}{x^4}\right)\left(x^4+\frac{1}{x^4}\right)$

$=x^8-\frac{1}{x^8}$

$\left(\because (a+b)(a-b)=a^2-b^2\right)$

Photo Proof:

(Set-D question No. 46) (Set-A question No. 41)

41. The sum of two numbers is 161. If one of the numbers is 30% more than the other then the numbers are

A) 71 and 90

B) 70 and 91

C) 54 and 107

D) 60 and 101

Initial Answer Key: B

Final Answer Key:

Solution :

41) Trial & error. Ans B

Photo Proof:

(Set-D question No. 94) (Set-A question No. 79)

79._____ is a major component of CNG.

A) Methane B) Ethane

C) Propane D) Butane

Initial Answer Key: A

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 60

Photo Proof:

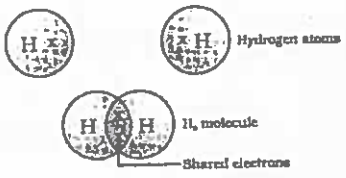


Figure 4.1
A molecule of hydrogen

Figure 4.2
Single bond between two hydrogen atoms

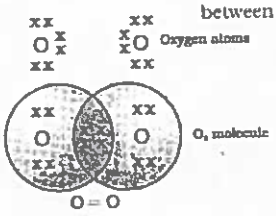


Figure 4.3
Double bond between two oxygen atoms

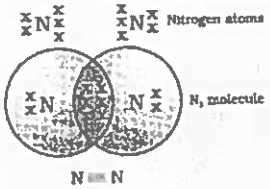


Figure 4.4
Triple bond between two nitrogen atoms

electronic configuration of the nearest noble gas, helium, which has two electrons in its K shell. We can depict this using dots or crosses to represent valence electrons (Fig. 4.1).

The shared pair of electrons is said to constitute a single covalent bond between the two hydrogen atoms. A single covalent bond is also represented by a line between the two atoms, as shown in Fig. 4.2.

The atomic number of chlorine is 17. What would be its electronic configuration and its valency? Chlorine forms a diatomic molecule, Cl_2. Can you draw the electron dot structure for this molecule? Note that only the valence shell electrons need to be depicted.

In the case of oxygen, we see the formation of a double bond between two oxygen atoms. This is because an atom of oxygen has six electrons in its L shell (the atomic number of oxygen is eight) and it requires two more electrons to complete its octet. So each atom of oxygen shares two electrons with another atom of oxygen to give us the structure shown in Fig. 4.3. The two electrons contributed by each oxygen atom give rise to two shared pairs of electrons. This is said to constitute a double bond between the two atoms.

Can you now depict a molecule of water showing the nature of bonding between one oxygen atom and two hydrogen atoms? Does the molecule have single bonds or double bonds?

What would happen in the case of a diatomic molecule of nitrogen? Nitrogen has the atomic number 7. What would be its electronic configuration and its combining capacity? In order to attain an octet, each nitrogen atom in a molecule of nitrogen contributes three electrons giving rise to three shared pairs of electrons. This is said to constitute a triple bond between the two atoms. The electron dot structure of N_2 and its triple bond can be depicted as in Fig. 4.4.

A molecule of ammonia has the formula NH_3. Can you draw the electron dot structure for this molecule showing how all four atoms achieve noble gas configuration? Will the molecule have single, double or triple bonds?

Let us now take a look at methane, which is a compound of carbon. Methane is widely used as a fuel and is a major component of bio-gas and Compressed Natural Gas (CNG). It is also one of the simplest compounds formed by carbon. Methane has a formula CH_4. Hydrogen, as you know, has a valency of 1. Carbon is tetravalent because it has four valence electrons. In order to achieve noble gas configuration, carbon shares these electrons with four atoms of hydrogen as shown in Fig. 4.5.

Such bonds which are formed by the sharing of an electron pair between two atoms are known as covalent bonds. Covalently bonded molecules are seen to have strong bonds within the molecule, but inter molecular forces are weak. This gives rise to the low melting and boiling

(Set-D question No. 77) (Set-A question No. 82)

82._____ solution of acetic acid in water is called vinegar.

A) 5-8% B) 8-9%

C) 4-6% D) 6-9%

Initial Answer Key: A

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 73

Photo Proof:

More to Know!

Alcohol as a fuel

Sugarcane plants are one of the most efficient convertors of sunlight into chemical energy. Sugarcane juice can be used to prepare molasses which is fermented to give alcohol (ethanol). Some countries now use alcohol as an additive in petrol since it is a cleaner fuel which gives rise to only carbon dioxide and water on burning in sufficient air (oxygen).

4.4.2 Properties of Ethanoic Acid

Ethanoic acid is commonly called acetic acid and belongs to a group of acids called carboxylic acids. 5-8% solution of acetic acid in water is called vinegar and is used widely as a preservative in pickles. The melting point of pure ethanoic acid is 290 K and hence it often freezes during winter in cold climates. This gave rise to its name glacial acetic acid.

The group of organic compounds called carboxylic acids are obviously characterised by their acidic nature. However, unlike mineral acids like HCl, which are completely ionised, carboxylic acids are weak acids.

Activity 4.7

- Compare the pH of dilute acetic acid and dilute hydrochloric acid using both litmus paper and universal indicator.
- Are both acids indicated by the litmus test?
- Does the universal indicator show them as equally strong acids?

Activity 4.8

- Take 1 mL ethanol (absolute alcohol) and 1 mL glacial acetic acid along with a few drops of concentrated sulphuric acid in a test tube.
- Warm in a water bath for at least five minutes as shown in Fig. 4.11.
- Pour into a beaker containing 20-50 mL of water and smell the resulting mixture.

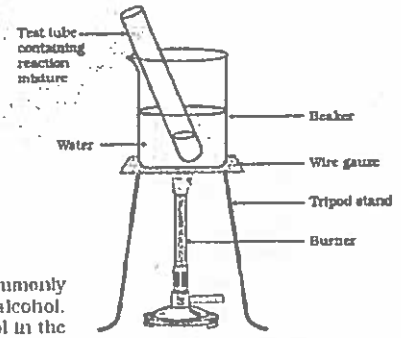
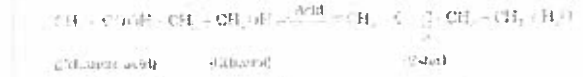


Figure 4.11
Formation of ester

Reactions of ethanoic acid:

(i) *Esterification reaction:* Esters are most commonly formed by reaction of an acid and an alcohol. Ethanoic acid reacts with absolute ethanol in the presence of an acid catalyst to give an ester –



Generally, esters are sweet smelling substances. These are used in making perfumes and as flavouring agents. On treating with sodium hydroxide, which is an alkali, the ester is converted back to alcohol and sodium salt of carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap. Soaps are sodium or potassium salts of long chain carboxylic acid.

(Set-A)

84. Esters react in the presence of acid or base to give alcohol and carboxylic acid is called

A) Esterification B) Saphonification

C) Hydrolysis D) Rancidity

Initial Answer Key: B

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 73

Photo Proof:

More to Know!

Alcohol as a fuel

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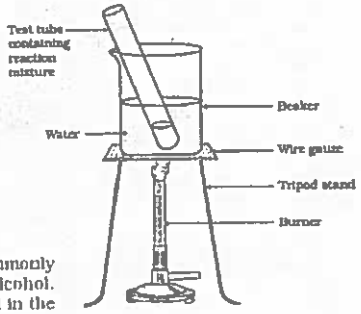

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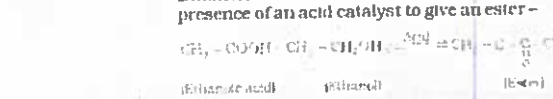


(Ethanoic acid) (Ethanol) (Ester)

Generally, esters are sweet-smelling substances. These are used in making perfumes and as flavouring agents. On treating with sodium hydroxide, which is an alkali, the ester is converted back to alcohol and sodium salt of carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap. Soaps are sodium or potassium salts of long chain carboxylic acid.

(Set-B question No. 61) (Set-A question No. 91)

91. pH of milk of magnesia is

A) 11 B) 10

C) 11.5 D) 10.5

Initial Answer Key: B

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 26

Photo Proof:

Activity 2.11

- Test the pH values of solutions given in Table 2.2.
- Record your observations.
- What is the nature of each substance on the basis of your observations?

Table 2.2

S. No	Solution	Colour of pH paper	Approx-imate pH value	Nature of substance
1	Saliva (before meal)			
2	Saliva (after meal)			
3	Lemon juice			
4	Colourless aerated drink			
5	Carrot juice			
6	Coffee			
7	Tomato juice			
8	Tap water			
9	1M NaOH			
10	1M HCl			

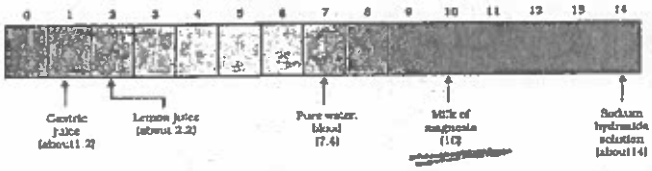


Figure 2.7 pH of some common substances shown on a pH paper (colours are only a rough guide)

The strength of acids and bases depends on the number of H^+ ions and OH^- ions produced, respectively. If we take hydrochloric acid and acetic acid of the same concentration, say one molar, then these produce different amounts of hydrogen ions. Acids that give rise to more H^+ ions are said to be strong acids, and acids that give less H^+ ions are said to be weak acids. Can you now say what weak and strong bases are?

2.3.1 Importance of pH in Everyday Life

Are plants and animals pH sensitive?

Our body works within the pH range of 7.0 to 7.8. Living organisms can survive only in a narrow range of pH change. When pH of rain water is less than 5.5, it is called acid rain. When acid rain flows into the rivers, it lowers the pH of the river water. The survival of aquatic life in such rivers becomes difficult.

(Set-A)

93. _____ acid is present in Tomato.

A) Oxalic B) Citric

C) Tartaric D) Methanoic

Initial Answer Key: A

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 28

Photo Proof:

Do You Know?

Nature provides neutralisation options

Nettle is a herbaceous plant which grows in the wild. Its leaves have stinging hair, which cause painful stings when touched accidentally. This is due to the methanoic acid secreted by them. A traditional remedy is rubbing the area with the leaf of the dock plant, which often grows beside the nettle in the wild. Can you guess the nature of the dock plant? So next time you know what to look out for if you accidentally touch a nettle plant while trekking. Are you aware of any other effective traditional remedies for such stings?

Table 2.3 Some naturally occurring acids

Natural source	Acid	Natural source	Acid
Vinegar	Acetic acid	Sour milk (Curd)	Lactic acid
Orange	Citric acid	Lemon	Citric acid
Tamarind	Tartaric acid	Ant sting	Methanoic acid
Tomato	Oxalic acid	Nettle sting	Methanoic acid

QUESTIONS

1. You have two solutions, A and B. The pH of solution A is 3 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?
2. What effect does the concentration of $H^+(aq)$ ions have on the nature of the solution?
3. Do basic solutions also have $H^+(aq)$ ions? If yes, then why are these basic?
4. Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)?

2.4 MORE ABOUT SALTS

In the previous sections we have seen the formation of salts during various reactions. Let us understand more about their preparation, properties and uses.

2.4.1 Family of Salts

Activity 2.13

- Write the chemical formulae of the salts given below.
  Potassium sulphate, sodium sulphate, calcium sulphate, magnesium sulphate, copper sulphate, sodium chloride, sodium nitrate, sodium carbonate and ammonium chloride.

(Set-C question No. 138) (Set-A question No. 123)

123. If the length of the metallic wire is doubled then the resistance of the wire

A) reduces by half

B) doubles

C) reduces by $\frac{1}{4}$

D) quadruples

Initial Answer Key: B

Final Answer Key:

Reference: NCERT

Book:

Author:

Publication:

Page No. 207, Chapter 12

Photo Proof:

resistance of the conductor depends (i) on its length, (ii) on its area of cross-section, and (iii) on the nature of its material. Precise measurements have shown that resistance of a uniform metallic conductor is directly proportional to its length (l) and inversely proportional to the area of cross-section (A). That is,

$$R \propto l \quad (12.8)$$

and

$$R \propto 1/A \quad (12.9)$$

Combining Eqs. (12.8) and (12.9) we get

$$R \propto \frac{l}{A}$$

or,

$$R = \rho \frac{l}{A} \quad (12.10)$$

where ρ (rho) is a constant of proportionality and is called the electrical resistivity of the material of the conductor. The SI unit of resistivity is Ω m. It is a characteristic property of the material. The metals and alloys have very low resistivity in the range of $10^{-8}\ \Omega$ m to $10^{-6}\ \Omega$ m. They are good conductors of electricity. Insulators like rubber and glass have resistivity of the order of 10^{12} to $10^{17}\ \Omega$ m. Both the resistance and resistivity of a material vary with temperature.

Table 12.2 reveals that the resistivity of an alloy is generally higher than that of its constituent metals. Alloys do not oxidise (burn) readily at high temperatures. For this reason, they are commonly used in electrical heating devices, like electric iron, toasters etc. Tungsten is used almost exclusively for filaments of electric bulbs, whereas copper and aluminium are generally used for electrical transmission lines.

Table 12.2 Electrical resistivity* of some substances at 20°C

	Material	Resistivity (Ω m)
Conductors	Silver	1.60×10^{-8}
	Copper	1.62×10^{-8}
	Aluminium	2.63×10^{-8}
	Tungsten	5.20×10^{-8}
	Nickel	6.84×10^{-8}
	Iron	10.0×10^{-8}
	Chromium	12.9×10^{-8}
	Mercury	94.0×10^{-8}
	Manganese	1.84×10^{-6}
Alloys	Constantan (alloy of Cu and Ni)	49×10^{-8}
	Manganin (alloy of Cu, Mn and Ni)	44×10^{-8}
	Nichrome (alloy of Ni, Cr, Mn and Fe)	100×10^{-8}
Insulators	Glass	$10^{10} - 10^{14}$
	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Paper (dry)	10^{12}

* *You need not memorise these values. You can use these values for solving numerical problems.*

(Set-D question No. 119) (Set-A question No. 136)

136. According to Fleming's left hand rule, the fore finger is pointed towards the direction of

A) Electric current
B) Magnetic field
C) Force exerted
D) Motion of the conductor

Initial Answer Key: B
Final Answer Key:
Reference: NCERT
Book:
Author:
Publication:
Page No. 235, Chapter 13
Photo Proof:

Let us now perform a variation of Activity 13.8 in which the moving magnet is replaced by a current-carrying coil and the current in the coil can be varied.

Activity 13.9

Take two different coils of copper wire having large number of turns (say 50 and 100 turns respectively). Insert them over a non-conducting cylindrical roll, as shown in Fig. 13.17. (You may use a thick paper roll for this purpose.)
Connect the coil-1, having larger number of turns, in series with a battery and a plug key. Also connect the other coil-2 with a galvanometer as shown.
Plug in the key. Observe the galvanometer. Is there a deflection in its needle? You will observe that the needle of the galvanometer instantly jumps to one side and just as quickly returns to zero, indicating a momentary current in coil-2. Disconnect coil-1 from the battery. You will observe that the needle momentarily moves, but to the opposite side. It means that now the current flows in the opposite direction in coil-2.

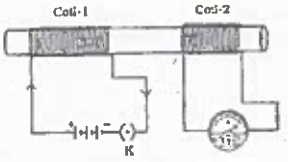


Figure 13.17
Current is induced in coil-2 when current in coil-1 is changed

In this activity we observe that as soon as the current in coil-1 reaches either a steady value or zero, the galvanometer in coil-2 shows no deflection.

From these observations, we conclude that a potential difference is induced in the coil-2 whenever the electric current through the coil–1 is changing (starting or stopping). Coil-1 is called the primary coil and coil-2 is called the secondary coil. As the current in the first coil changes, the magnetic field associated with it also changes. Thus the magnetic field lines around the secondary coil also change. Hence the change in magnetic field lines associated with the secondary coil is the cause of induced electric current in it. This process, by which a changing magnetic field in a conductor induces a current in another conductor, is called electromagnetic induction. In practice we can induce current in a coil either by moving it in a magnetic field or by changing the magnetic field around it. It is convenient in most situations to move the coil in a magnetic field.

The induced current is found to be the highest when the direction of motion of the coil is at right angles to the magnetic field. In this situation, we can use a simple rule to know the direction of the induced current. Stretch the thumb, forefinger and middle finger of right hand so that they are perpendicular to each other, as shown in Fig. 13.18. If the forefinger indicates the direction of the magnetic field and the thumb shows the direction of motion of conductor, then the middle finger will show the direction of induced current. This simple rule is called Fleming's right-hand rule.

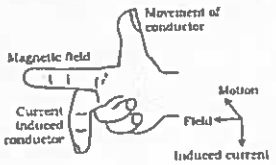


Figure 13.18
Fleming's right-hand rule

(Set-C question No. 114) (Set-A question No. 149)

149. Which of the following is not an example of conventional energy source ?

A) Wood B) Gobar gas

C) Nuclear energy D) Coal

Initial Answer Key: C

Final Answer Key:

Reference: NCERT

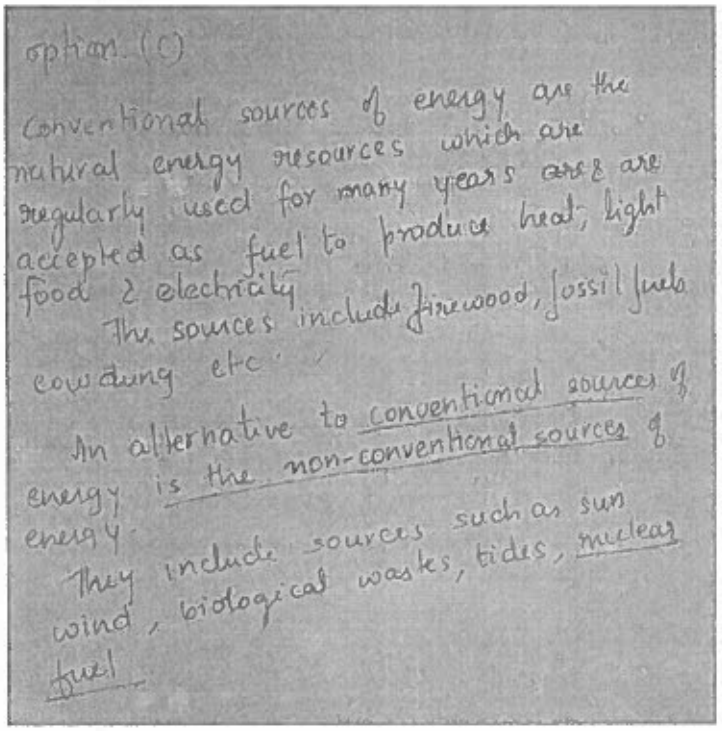
Book:

Author:

Publication:

Page No. 255, Chapter 14

Photo Proof:



option (C)

Conventional sources of energy are the natural energy resources which are regularly used for many years and are accepted as fuel to produce heat, light, food & electricity.

The sources include firewood, fossil fuels, cowdung etc.

An alternative to conventional sources of energy is the non-conventional sources of energy.

They include sources such as sun, wind, biological wastes, tides, nuclear fuel.