CHAPTER 3: ENERGY

Define and write the S.I unit of the following

1. **Define work**
   Work is said to be done when a body experiences displacement in the direction of force applied. S.I unit is Nm (Newton meter)
   Work = force * displacement

2. **Define energy**
   Energy is defined as the ability to do work. SI unit is joule (J).

3. **Define potential energy**
   Energy possessed by a body by virtue of its position is known as potential energy.
   SI unit is joule (J).

4. **Define gravitational potential energy**
   The energy acquired by the body when is raised at some height from the ground level.

   Gravitational potential energy = mass * gravity * height (m*g*h)

5. **Define elastic potential energy**
   The energy possessed by the body when the body is stretched, compressed or deformed.

6. **Define Kinetic Energy.**
   The energy possessed by a body due to its motion is called kinetic energy.
   Kinetic energy = ½ mv^2 (m= mass, v= velocity).SI unit is Joule (J)

Answer the following:

1. **What are the conditions for work done?**
   i. The force must act on the body.
   ii. The body should be displaced.

2. **Explain the energy in action.**

Energy in action:

i. **Electrical energy:** Energy possessed by moving electrons.

ii. **Heat energy:** Heat is a form of energy which causes a sensation of hotness or coldness in a body. It is called thermal energy.

iii. **Light energy:** Light or luminous energy is the energy which enables us to see things.

iv. **Sound energy:** it is a form of energy which produces the sensation of hearing in our ears. It is produced by vibrating bodies.

3. **Explain the stored form of energy.**

Stored form of energy

Magnetic energy: it is the energy stored by a magnet, producing a magnetic field around it.

Chemical energy: it is the energy stored in a compound or a matter, which is available for work during chemical process.

Muscular energy: it is the energy stored in the muscles of human beings and animals.

Nuclear energy: it is the energy stored in the nucleus of an atom. This energy is released during fission or fusion reactions.

4. **State the law of conservation of energy.**

Law of conservation of energy: This law states that energy can neither be created nor be destroyed, but it transforms from one form to another.

5. **What is energy transformation? Give some examples.**

Energy transformation: the change of one form of energy to another is called energy transformation.

E.g., Fans, mixers and grinders convert electrical energy into mechanical energy

6. **Explain the sources of energy.**

Sources of energy:

Conventional sources are non- renewable sources.

E.g., Wood, coal and petroleum.

Non- conventional sources are renewable sources.

E.g., sun

Wind: wind energy is produced in wind mills.

Running water: hydro energy: produces hydroelectricity

Biomass: Wastes generated in homes and industries are used to generate electricity.

Tides: tidal energy is the energy harnessed by the rise and fall of sea level.

Fossil fuels: E.g., Coal, petroleum products and natural gas.

Write the formula and unit for the following

1. **Work done**
   Work = force * displacement
   S.I unit of Force is newton
   S.I unit of displacement is meter
   S.I unit of work done is Newton meter (Nm)

2. **Potential Energy**
   Gravitational potential energy = mass * gravity * height (m*g*h)
   S.I unit of mass is joule (J)

3. **Kinetic Energy.**
   Kinetic energy = ½ mv^2 (m= mass, v= velocity).
   SI unit is Joule (J)

Answer the following:

1. **Compare work and energy.**
   Work is said to be a channelized form of energy, whereas energy can be seen as a stored form of work.

2. **Explain the steps to be taken for conservation of energy.**
   a. Select the most energy efficient models when buying electrical appliances.
   b. Clean the AC air filters as recommended.
   c. Buy energy efficient bulbs such as the LED lights.
   d. Switch off the lights and fans while leaving the room.
   e. Do not waste clean drinking water.

Numerical:

1. **A force of 10 N displaces an object to 10 m. Calculate the work done.**

   Force = 10 N

   Displacement = 10 m

   Work Done = F*D = 10 N * 10 m = 100 Nm

2. **100 J of work is done to displace an object through 10 m. calculate the force applied.**

   Work done = 100 J

Displacement = 10 m

Force =?

W = F * S

F = W/S = 100/10 = 10 N

3. **A force of 50 N is applied to do a work of 500 J to displace an object through x meter. Find x.**

   Force = 50 N

   Work Done = 500 J

   Displacement =?

   W = F*S

   S = W/F = 500/50 = 10 m

4. **An object of mass 50 Kg is place d at height 50 m. find the energy possessed by the body.**

   Mass = 50 kg

   height =50 m

   Potential Energy = Mass * Gravity * height

   = 50 * 10 * 50 = 25000 J

5. **The energy possessed by a ball of mass 40 kg at height h is 400 J. find the height at which it is kept.**

   Mass = 40 kg

   P.E = 400 J

   Height =?

   P.E = mgh

   h = P.E / mg = 400/40*10 = 1m

6. **The stone kept at height 8 m has energy 40 J. find the mass of the ball.**

   Height = 8m

   P.E = 40 J

   Mass =?

P.E = mgh

m = P.E/gh

= 40/10*8 = 0.5 kg

7. **Find the energy possessed by the body of mass 50 kg moving with a speed of 50 m/s.**

   Mass = 50 Kg

   Velocity = 50 m/s

   Kinetic Energy = ½ $m*v^2$

   = ½ * 50 * 50*50

   = 62500 J

8. **The energy possessed by a body of mass 100 kg moving with a speed v m/s is 500 J. find the speed.**

   Mass = 100 Kg

   K.E = 500 J

   Velocity =?

   Kinetic Energy = ½ $m*v^2$

   V^2= (2*K. E)/m

   = (2*500)/100 = 10

   V = 3.162 m/s

9. **The body moving with a speed 50 m/s has energy 500 J. find the mass of the body.**

   Velocity = 50 m/s

   K.E = 500 J

   Mass =?

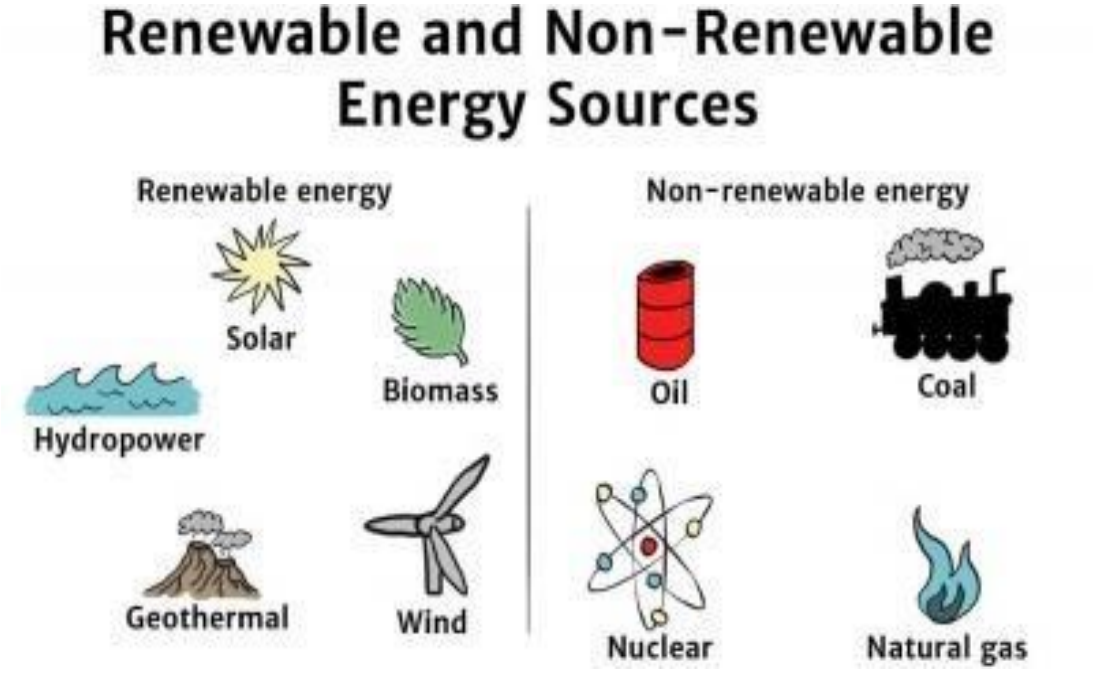
   Kinetic Energy = ½ $m*v^2$

   Mass = (2*K. E)/v^2

   = 0.4 Kg

WORKSHEET

1. **Find the work done in the following cases**
   Case i : W = F*S = 45 * 3.2 = 144 Nm
   Case ii: W = F*S = 4 * 0.75 m = 3Nm
   Case iii: W = F*S = 114000*4 = 456000 Nm
2. **Observe the below formula triangle and write the formula to find**
   iv. Work = F * d
   v. Force = W/d
   vi. Displacement = W/F
3. **Identify the energy possessed by the body in each case.**
   Hammer in 1st position: Potential Energy
   Hammer in 2nd position : Kinetic Energy
   Hammer in 3rd position: Potential Energy
   Arrow in 1st position: Potential Energy
   Arrow in 2nd position: Kinetic Energy
4. **Observe the figure the calculate the quantities asked.**
   Case 1:
   P.E = 0
   K.E = ½ $m*v^2$ = (60*8*8)/2 = 1920 J
   M.E = K.E + P.E = 1920 J + 0 = 1920 J
5. **Identify the energy sources and classify them under conventional and non-conventional energy.**



6. **Identify the energy transformations shown in the figure**

   i. Chemical Energy to Mechanical Energy

   ii. Chemical Energy to Light Energy

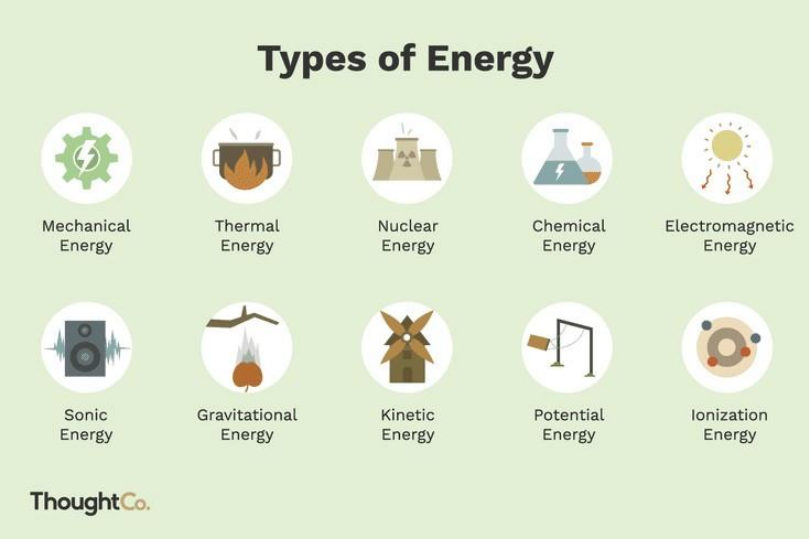
   iii. Electrical Energy to Light Energy

   iv. Chemical Energy to Mechanical Energy

   v. Solar Energy to Chemical Energy

   vi. Electrical Energy to Heat Energy

7. **Identify the type of energy**



CHAPTER 4: LIGHT ENERGY

Answer the following:

1. **Define reflection of light**

   It is defined as the phenomena in which the ray of light bounces back as it falls on a smooth or polished surface like a mirror

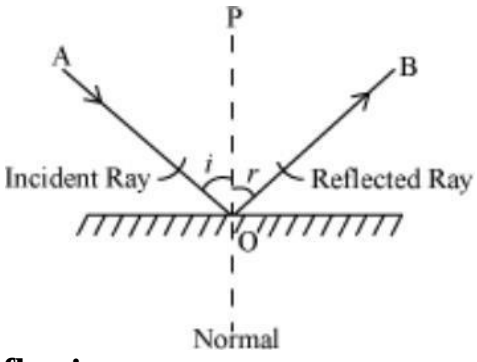
2. **What are the key factors that make a mirror different from other objects?**

   i. It reflects most of the light falling on it

   ii. It does not absorb light.

   iii. It does not allow light to pass through.

3. **Define the terms related to reflection with neat diagram.**



Terms related to reflection

- **Plane:** It is a flat two-dimensional surface with no thickness.
- **Ray:** The path of light coming from a point source in a given direction is represented by a line with arrow which is called ray of light.
- **Incident ray**: The ray of light falling on a surface is called incident ray.
- **Point of incidence:** The point on the mirror surface where the incident ray strikes in called point of incidence
- **Reflected ray:** incident ray bouncing back into the same medium is called reflected ray.

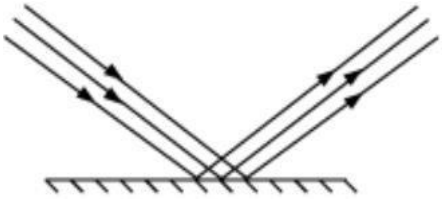
- **Normal:** A straight line drawn perpendicular to the reflecting surface at a point of incident in called normal.
- **Angle of incidence:** The angle formed between incident ray and normal in called angle of incidence.
- **Angle of reflection:** The angle formed between the reflected ray and normal.

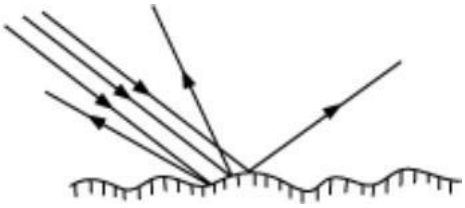
4. With a neat diagram explain regular and irregular reflection.

Regular reflection: a parallel beam of light falls on a smooth and highly polished surface, the reflected rays are parallel to each other, such reflection is called regular reflection. The image formed will be clear.

Irregular reflection: When a parallel beam of light falls on a rough surface the reflected ray scatters in different direction, this kind of reflection is called irregular reflection or diffused reflection.

The laws of reflection are valid in regular as well as irregular or diffused reflections. The image formed will not be clear





5. State the laws of reflection.

Laws of reflection:

- The incident ray, the reflected ray and the normal to the surface of the mirror all lying in same plane.
- Angle of incidence is always equal to angle of reflection

6. Differentiate between real and virtual image.

Real image:

- It is always inverted
- it can be captured on the screen
- It is formed on the location where light rays actually meets

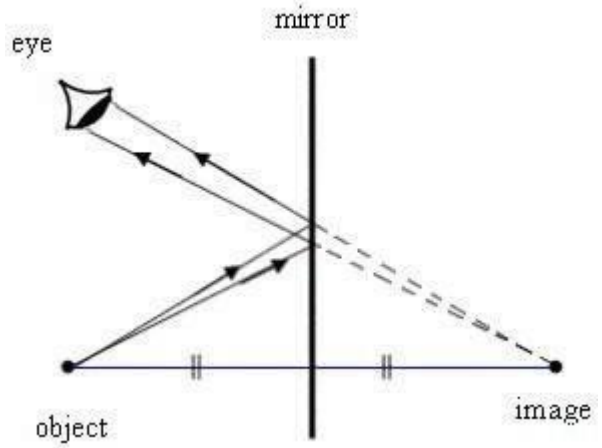
Virtual image

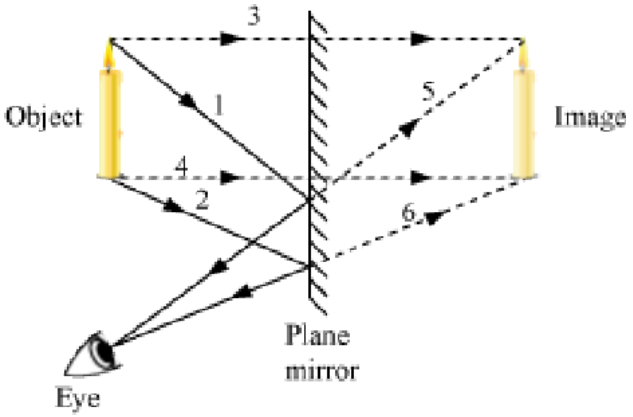
- It is always upright
- It cannot be captured on screen
- It is formed in locations where light rays do not actually meets.

7. Draw the ray diagram for the formation of image by

iii. Point object

iv. Extended object.





8. Define lateral inversion.

The phenomena of the mirror in which left side of a object appears to be on right side in its image and wise-versa is called lateral inversion.

9. What are the characteristics of image formed by plane mirror?

Characteristics of an image by a plane mirror:

- Virtual and upright.
- Laterally inverted.
- Same size
- It is behind the mirror at the same distance behind the mirror.

10. What are the applications of plane mirror?

a. We use plane mirror as dressing table mirrors
b. In barber shop, a plane mirror is used to show the customer the back side of his head.
c. Army personnel and scouts use plane mirror for signaling.
d. In solar cookers the plane mirrors are used to direct sunlight to the interior of the cooker.

11. What is the speed of light in?

- Air = $3 * 10^8$ m/s
- Water =$2 * 10^8$ m/s
- Glass = $2.25 * 10^8$ m/s

12. What are primary colors?

The colors of light that produce white light when combine with correct intensity are called primary colors. Red, blue and green are primary colors.

13. What are secondary colors?

The colors produced by mixing any primary colors of light are called secondary colors or composite colors. Magenta, cyan and yellow are secondary colors.

14. What are complementary colors.

They are the two colors which give white light when mixed together. Red and cyan are complimentary colors.

WORKSHEET

1. **Identify A, B, N, i. r from the diagram shown below**

   A - Incident Ray

   B – Reflected Ray

   N- Normal

   i – angle of incidence

   r- angle of reflection

2. **Find the angle of reflection from the image shown below.**

   $i = 90^0 - 65^0 = 25^0$

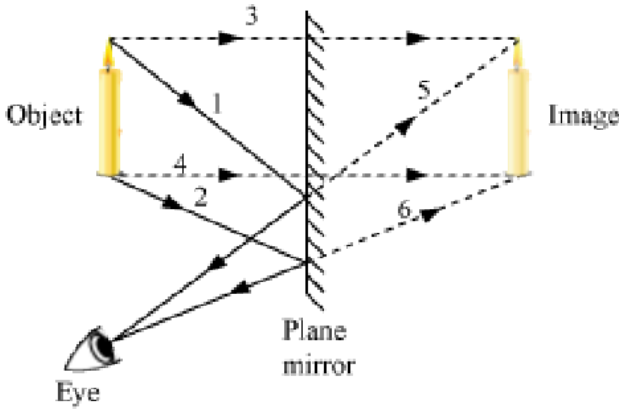
   $i = r = 25^0$

3. **Identify the type of reflection that had occurred in the surface of water with reason.**

   a. Regular Reflection because clear image is obtained.

   b. Irregular reflection because the image formed is diffused.

4. **Complete the ray diagram for the formation of image.**



5. **How would the word shown in the paper appear in the mirror? What is the phenomenon.**

6. Identify the colors obtained

a. Red + Green = Yellow

b. Red + Blue = Magenta

c. Blue + green = Cyan

d. Magenta + yellow = red

e. Magenta + cyan = blue

f. Cyan + yellow = green

7. Identify the pigment color.

a. Blue
b. magenta

a. white
b. yellow
c. cyan
d. red
e. green
f. black
g. blue
h. yellow
i. green

	COLOUR ABSORBED	COLOUR REFLECTED
A	Red	Blue
B	Blue	Red
C	None	magenta
D	Red	Cyan
E	Blue	Green
F	Green	Black