General Science (GSC101)
Solved Assignments

Solution of Assignment # 1: (Fall 2015)

General Science (GSC101)

TOTAL MARKS: 25

Due Date: 23/11/2015

Question No. 1

Define the following terms and also write their symbolic representation.

i. Newton

ii. Gravitational Potential Energy

iii. Momentum

iv. Kinetic Friction **Marks = 2 + 2 + 2 + 2 = 8**

Solution:

i. **Newton:** Newton is the SI unit of force and represented by symbol **"N"**. It is equal to the force which produces an acceleration of one metre per second per second in an object of mass one kilogram. Newton

   $1\ N = 1\ kg \times 1\ ms^{-2}$

ii. **Gravitational Potential Energy:** Energy possessed by an object due to its position in the gravitational field where acceleration due to gravity is assumed to be constant i.e. $9.8\ ms^{-2}$. It is represented by **"GPE"**.

iii. **Momentum:** The product of mass and velocity of a moving body is known as momentum. Momentum = mass x velocity or $P = m \times v$

   Its symbolic representation is **"P"**.

iv. Kinetic Friction: when two objects are moving relative to each other(like a sled on the ground), friction is present between these two objects which is known as kinetic friction. It is represented by **"f_K"**.

Question No. 2

Define work. Upon which factors work done depends? Calculate work done at

$\theta = 0^o$, 90^o & 180^o **Marks = 2 + 2 + 6 =10**

Solution:

It is said a force to do a work, if a force is acting on the body and body covers some displacement in the direction of force.

Work done depends on the following three factors

1. Force acting
2. Displacement in the direction of force
3. Angle at which the force acts

$\theta = 0^o$	$\theta = 90^o$	$\theta = 180^o$
$W = Fs[Cos0]$	$W = Fs[Cos90]$	$W = Fs[Cos180]$
$W = Fs[1]$	$W = Fs[0]$	$W = Fs[-1]$
$W = Fs$	$W = 0$	$W = -Fs$

From above results, when $\theta = 0^o$, maximum work is done, when $\theta = 90^o$ work done is zero and when $\theta = 180^o$, work done is negative.

Question No. 3

Answer the following question. **Marks = 2 + 1 + 2 + 2 = 7**

a) What is motion?

b) What is a reference point?

c) If the slope is zero in a speed graph, then what about the object's motion?

d) How do you make a change in velocity?

(Answer should not be exceeding more than one sentence).

Solution:

a) A change in position compared to a reference point.

b) Something that does not move.

c) If the slope is zero in a speed graph, then this shows the object is not moving.

d) You either change the direction, speed, or both.

Solution of Assignment # 2: (Fall 2015)

General Science (GSC101)

TOTAL MARKS:25

Due Date: 23/01/2016

Question No. 1

Discuss Quantum Numbers. **Marks =8**

Solution:

Quantum Numbers

Quantum numbers are used to explain the structure of atom. These numbers are used to describe the distribution of electrons in space around the nucleus. There are four quantum numbers which are given below:

Principal Quantum Number *n*

The main energy level, or shell, that an electron occupies in an atom is described by the principal quantum number (*n*). *n* may be any positive integer:

$n = 1, 2, 3, \ldots\ldots$

When $n = 1$, it is the first main energy level, or the first shell. When $n = 2$, it is the second shell. And, so on. A main energy level or shell is the main region around the nucleus in which an electron may be present.

Azimuthal Quantum Number, *l*

The azimuthal quantum number describes an atomic orbital that determines its orbital angular momentum and describes the shape of the orbital. It denotes the shape of the region in space an electron occupies. Its values are given by:

$l = 0$ to $(n - 1)$

Thus, when $n = 1$, then

$l = 0$

When $n = 2$, then $l = 0, 1$

When $n = 3$, then $l = 0, 1, 2$

And, so on.

Thus, the values of *l* designate subshells or sublevels that electrons can occupy in a main shell. Each value of *l* is given a letter notation. Thus:

$l = 0,\ 1,\ 2,\ 3,\ 4,\ 5, \ldots\ldots$

s, p, d, f, g, h,.....

Magnetic Quantum Number, *m*

This number divides the subshell into individual orbitals which hold the electrons. It designates the spatial orientation of the region an electron occupies. This region is called an orbital. An orbital is the region around the nucleus in which the probability of finding an electron is maximum. Each subshell is composed of one or more orbitals. The values of *m* are given by:

$m = -l, \ldots\ldots 0 \ldots\ldots +l$

Thus, when $l = 0$, $m = 0$

When $l = 1$, $m = -1, 0, +1$

When $l = 2$, $m = -2, -1, 0, +1, +2$

When $l = 3$, $m = -3, -2, -1, 0, +1, +2, +3$

Values of m serve to determine the orientation of an orbital in space relative to the other orbitals.

Spin Quantum Number, s

It refers to the spin of an electron. Electron has a spin, that is, it rotates about its own axis. An electron can spin only in either of two directions, clockwise or anticlockwise. Therefore, *s* has only two values +1/2 and –1/2.

Question No. 2

Differentiate between **Marks = 4+4**

i. ionic and covalent bond
ii. atomic and molecular mass

Solution:

Difference between atomic and molecular mass:

- The atomic weight corresponds to the weight of an element, while the molecular weight corresponds to the weight of a chemical compound.
- Atomic weight is measured in units of atomic mass units (amu) when referring to single atoms, or in grams/mole when referring to moles of an element. The atomic weight of an element is equal to the number of protons plus the number of neutrons.
- Molecular weight (also called "molar mass" or "gram formula mass") is measured in units of grams/mole when referring to moles of an element. The molecular weight of a compound is found by adding the atomic weights of all of the atoms in the element. Water, for example, has a molecular weight of 18 grams/mole, as there are two hydrogen atoms that each weigh 1 gram/mole and one oxygen atom that weighs 16 grams/mole.

Difference between ionic and covalent bond:

- Ionic compounds have ionic compounds while covalent compounds have covalent bonds.
- Since in ionic compounds, ions are held together through very strong electrostatic forces, ionic compounds are solids at room temperature. Whereas covalent compounds consist of molecules which are held together through weak inter molecular force, there for they may be solids, liquids or gases.
- Ionic compounds have higher melting and boiling points than covalent compounds.
- In general, ionic compounds are soluble in water and insoluble in organic solvents. While covalent compounds are generally insoluble in water and soluble in organic solvents.
- Ionic compounds don't conduct electricity as such but do so in molten state. Covalent compounds don't conduct electricity in general.

Question No. 3

Calculate the mass of copper at a temperature of 110 °C required to raise the temperature of 500 g of water from 25.0 °C to 29.0 °C, assuming no energy is lost to the surroundings. Given that the specific heat capacity of water is 11 times that of copper**.** **Marks = 5**

Solution:

Given data:

Temperature of copper = T_1 = 110°C

Density of copper = D_1 = Cu

Mass of copper = m_1 = ?

Initial temperature of water = T_2 = 25 °C

Final temperature of water = T_3 = 29 °C

Density of water = D_2 = 11 times the density of Cu = 11 Cu

Mass of water = m_2 = 500g = 0.5 kg

Heat lost by copper = heat gained by water

$m_1 (T_1 – T_3) D_1 = m_2 (T_3 - T_2) D_2$

$m_1 (110 - 29)$ Cu= 0.5 (29 - 25) 11Cu

m_1 (85) Cu= 0.5 x 4 x 11Cu

85 m_1 = 22

m_1 = 22/85 = 0.2588 kg = 0.26 kg

Question No. 4

A balloon contains 8.5 L of He. The pressure is reduced to 3 atm and the balloon expands to occupy a volume of 27.4 L. What was the initial pressure exerted on the balloon? **Marks = 4**

Solution:

Given data:

Initial volume = V_1 = 8.5 L

Final volume = V_2 = 27.4 L

Final pressure = P_2 = 3atm

Initial pressure = P_1 =?

According to Boyle’s Law,

At constant temperature $P_1V_1 = P_2V_2$

$P_1 = (P_2V_2)/ V_1$

$P_1 = (3 \times 27.4) / 8.5$

$P_1 = (82.2) / 8.5 = 9.7$ atm

Solution of Assignment # 1: (Spring 2016)

GENERAL SCIENCE (GSC101)

Total Marks: 25

Due Date: 6th May, 2016

Question No. 1

Define the following terms

i. Relative motion

ii. Slop of a graph

iii. Constant Acceleration

iv. Free body Diagram

v. Sliding Friction

Marks = 2 + 2 + 2 + 2+2 = 10

Solution:

i. Relative motion

Velocity of the moving objects with respect to other moving or stationary object is called relative velocity and this motion is called relative motion.

ii. Slop of a graph

Slop of a graph is a mathematical ratio of vertical change (change in value of y) to the horizontal change (change in value of x) between any two distinct points on a line.

iii. Constant Acceleration

When a moving object changes its velocity by the equal amount per second, the body is said to be moving with constant acceleration.

iv. Free body Diagram

A free body diagram is simply a diagram showing all the forces acting on an object, the force's direction and its magnitude. For example four forces act on a moving car on road, weight of car downward, reaction of road upward, drive force in direction of motion and friction force in opposite to motion.

v. Sliding Friction

A frictional force created by two objects when the surface of an object slide against the surface of another object called Sliding Friction.

Question No. 2

A car starts from rest and accelerates steadily for 4s at 5.5 m/s^2.

i. Find out the value of final velocity of the car?

ii. How far will the car travel?

Marks = 2.5 + 2.5 =5

Solution:

Given data:

Acceleration a = 5.5 ms^{-2}

Time t = 4 s

Find:

Final Velocity V_f = ?

Distance travel S =?

Solution:

$$1^{st}\ Equation$$

$$V_f = V_i + at$$

$$V_f = 0 + 5.5ms^{-2} \times 4s$$

$$V_f = 22ms^{-1}$$

$$2^{nd}\ Equation$$

$$S = V_i t + \tfrac{1}{2} at^2$$

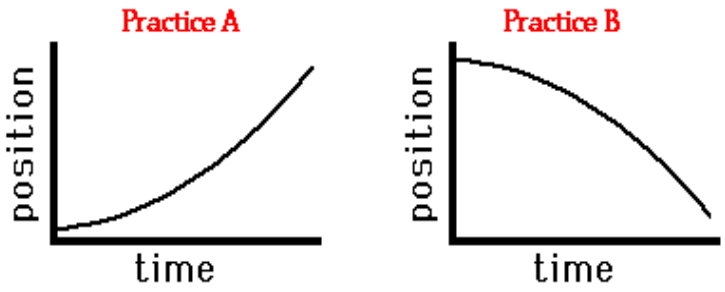
$$S = 0 \times 4s + \tfrac{1}{2} \times 5.5ms^{-2} \times (4\,\mathrm{s})^2$$

$$S = 0 + \tfrac{1}{2} \times 88$$

$$S = 44m$$

Question No. 3

Describe the motion of the objects depicted by the two plots below. In your description, be sure to include such information as the direction of the velocity vector (i.e., positive or negative), whether there is a constant velocity or an acceleration, and whether the object is moving slow, fast, from slow to fast or from fast to slow. Write the complete description in your answer.



Marks = 2.5 + 2.5 =5

Solution:

Practice A

The object has a positive or rightward velocity (note the + slope). The object has a changing velocity (note the changing slope); it is accelerating. The object is moving from slow to fast since the slope changes from small to big.

Practice B

The object has a negative or leftward velocity (note the – slope). The object has a changing velocity (note the changing slope); it has acceleration. The object is moving from slow to fast since the slope changes from small to big.

Question No. 4

A rightward tension force of 395N is applied on a wooden crate to drag it with a constant velocity 0.890 ms^{-1} on the floor. Calculate the mass of wooden crate. The coefficient of kinetic friction is 0.795 between floor and wooden crate.

Marks = 5

Solution:

Given data:

Velocity V = 0.890 ms^{-1}

Friction force $\boldsymbol{f}$ = 395 N

Coefficient of friction μ_k=0.795

Find:

Mass of wooden crate $\boldsymbol{m}$ =?

Solution:

Velocity is constant than acceleration is zero

$$F = ma$$
$$a = 0$$
$$F = 0$$
$$f_K = \mu_K R$$
$$395N = 0.795R$$
$$\frac{395N}{0.795} = R$$
$$R = 496.8N$$
$$R = W = mg$$
$$R = mg$$
$$\frac{R}{g} = m$$
$$\frac{496.8N}{9.8ms^{-2}} = m$$
$$m = 50.67kg$$

Solution of Assignment # 2: (Spring 2016)

GENERAL SCIENCE (GSC101)

Total Marks: 20

Due Date: 29th June, 2016

Question No. 1

How is it possible that a ray of light passes from a medium A to medium B without any change in direction? Explain your answer.

Marks = 3

Solution:

This is only possible when two media have the same refractive index. When ray of light moves from air to glass than due to different refractive indices speed of light changes, the ray of light changes its direction through the next medium or appear to bend and frequency of light remain the same.

Question No. 2

A tank truck was filled with 45,725 L of gasoline in Peshawar where the temperature was 28.0°C. The gasoline was delivered to Swat where the temperature was -12.0°C. Volume expansion coefficient of Gasoline is 950×10^{-6} °C^{-1}.

a) Find out the amount of gasoline delivered in litres

b) Infer the volume of the gasoline due to changed temperature

Marks =4+3= 7

Solution:

a) Co-efficient of Volume Expansion

$$\beta = \frac{V2 - V1}{V1(T2 - T1)}$$

$$V2 = \beta V1(T2 - T1) + V1$$

$$V2 = (950\times10^{-6.0} C^{-1})\times(45,725L)\times(-12.0^{0}\,C - 28.0^{0}\,C) + (45,725L)$$

$$V2 = 4.4\times10^{4} L$$

b) The gasoline volume decreased because the temperature decreased. The mass of the gasoline remained the same.

Question No. 3

What are different types of chemical reactions? Explain with examples.

Marks = 5

Solution:

There are a number of types of reactions.

1. Addition reactions:

The reactions in which two or more substance react to form a single substance. Ethene reacts with hydrogen to form ethane.

$C_2H_4 + H_2 \rightarrow C_2H_6$

2. Substitution reaction:

The reactions in which one substance is replaced by another substance from a molecule:

$CH_3\text{-}Cl + NaOH \rightarrow CH_3\text{-}OH + NaCl$

This reaction is also known as double displacement reaction.

3. Elimination reaction:

The reactions in which one or more atoms are eliminated from a molecule. For example, removal of H_2O from ethanol to form ethene.

$CH_3\text{-}CH_2\text{-}OH \rightarrow CH_2{=}CH_2 + H_2O$

4. Oxidation-Reduction Reactions

Many reactions involve transfer of electrons from one atom to another atom. These reactions are known as oxidation-reduction reactions. The loss of electrons from an atom is known as oxidation, while the gain of electrons by an atom is called reduction. Oxidation and reduction always take place simultaneously and the extent of oxidation is equal to the extent of reduction. That is, the loss of electrons is equal to the gain of electrons. The substance that undergoes oxidation is known as the reducing agent, and the substance that undergoes reduction is known as the oxidizing agent.

5. Combustion reactions:

Combustion means burning, and it is the reaction of a substance with oxygen. In a combustion reaction heat is produced. For example, the reaction of methane with oxygen is a combustion reaction.

$CH_4 \quad + \quad O_2 \rightarrow CO_2 + H_2O$

Generally in a combustion reaction, carbon dioxide and water are produced.

6. Neutralization reactions:

When an acidic solution is added to a basic solution in the right proportion, the properties of each are lost, and a salt and water are formed. This process is called **neutralization.**

"The reaction between an acid and a base that forms a salt and water is called neutralization".

For Example,

$$HCI\ (aq) + NaOH\ (aq) \rightarrow NaCI\ (aq) + H_2O$$

$$HNO_3\ (aq) + NaOH\ (aq) \rightarrow NaNO_3\ (aq) + H_2O$$

Chemical reactions may occur in solution or gaseous form. Generally, the chemical reactions are carried out in solution. Water and organic solvents are used for this purpose.

Question No. 4

How can you distinguish between a chemical change and physical change? Explain with suitable examples from your daily life.

Marks = 5

Solution:

During a chemical change a new substance is formed while during a physical change no new substance is formed. For example, burning of wood is a chemical change while change of water into ice is a physical change. During a chemical change a chemical reaction occurs whereas during a physical change no chemical reaction occurs. Chemical change is generally a permanent change, while physical change is only a temporary change and can be reversed easily. A physical change is reversible, a chemical change is not. For example, the freezing of water would be a physical change because it can be reversed, whereas the burning of wood is a chemical change.

Examples of Physical Changes

In a physical change no new chemical substances forms. Changing state of a pure substance between solid, liquid, and gas phases of matter are all physical changes, since the identity of the matter does not change. Few examples of physical changes from our daily life are given below

- Crumpling a sheet of Aluminium foil
- Melting an ice cube
- Casting silver in a mold

- Breaking a bottle
- Boiling water
- Mixing sand and water
- Dissolving sugar and water
- Shredding paper
- Chopping wood
- Mixing red and green marbles
- Sublimating dry ice

Examples of Chemical Changes

A new compound (product) results from a chemical change as the atoms rearrange themselves to form new chemical bonds. Few examples of chemical changes from our daily life are given below

- Burning wood
- Souring milk
- Mixing acid and base
- Digesting food
- Cooking an egg
- Heating sugar to form caramel
- Baking a cake
- Rusting of iron
- Explosion of fireworks
- Electroplating a metal
- Using a chemical battery
- Mixing baking soda and vinegar to produce carbon dioxide gas
- Rotting bananas

Solution of Assignment 3: (Spring 2016)

General Science (GSC101)

TOTAL MARKS: 25

Due Date: 29/07/2016

Question No.1

How many types of corrosion prevention? Write a note on any two types.

Marks 5

Solution:

The protection of corrosion can be classified as follows:

1. Active corrosion protection
2. Passive corrosion protection
3. Permanent corrosion protection
4. Temporary corrosion protection

1. Active Corrosion Protection:

The aim of active corrosion protection is to influence the reactions which proceed during corrosion. It is possible to control the corrosion reaction in such a manner that corrosion is avoided. Active corrosion protection helps reduce or avoid corrosion by means of manipulation of the corrosion process, corrosion material selection, project engineering, design and manufacturing. Examples of such an approach are the development of corrosion-resistant alloys and the addition of such materials to the metal which can inhibit corrosion.

2. Passive Corrosion Protection

In passive corrosion protection, the metal is mechanically isolated from the damaging environment. For example by using protective layers, films or other coatings rusting can be avoided. Since this type of corrosion protection does not change either the general ability of the package contents to corrode or the aggressiveness of the corrosive agent. Due to this reason this approach is known as passive corrosion protection. In this approach, corrosion may occur within a very short time if the protective layer, film or other coatings is destroyed at any point. Examples of permanent passive corrosion protection methods are tin plating, galvanizing, coatings with protective materials, enameling and plating.

Question No.2

How nitric acid is prepared industrially? Explain by each chemical reaction.

Marks 6

Solution:

Nitric Acid, HNO_3

Nitric acid is an important compound of nitrogen. It is a strong mineral acid. It is mono-basic acid. It is one of the common acids used extensively in laboratories and industries.

Preparation of Nitric acid:

Nitric acid is prepared industrially by a method known as **Ostwald's method**.

In this method nitric acid is prepared by the oxidation of ammonia.

Raw materials which are required for the preparation of Nitric Acid are:

- Ammonia NH_3
- Oxygen O_2
- Water H_2O

There are three main steps:

1. Oxidation of ammonia to nitric oxide
2. Oxidation of nitric oxide to NO_2.
3. Reaction of NO_2 with water to produce nitric acid.

Chemical reactions are shown by the chemical equations as follows:

$$4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$$

$$2NO + O_2 \longrightarrow 2NO_2$$

$$3NO_2 + H_2O \longrightarrow 2HNO_3 + NO$$

Question No. 3

Explain the following terms:

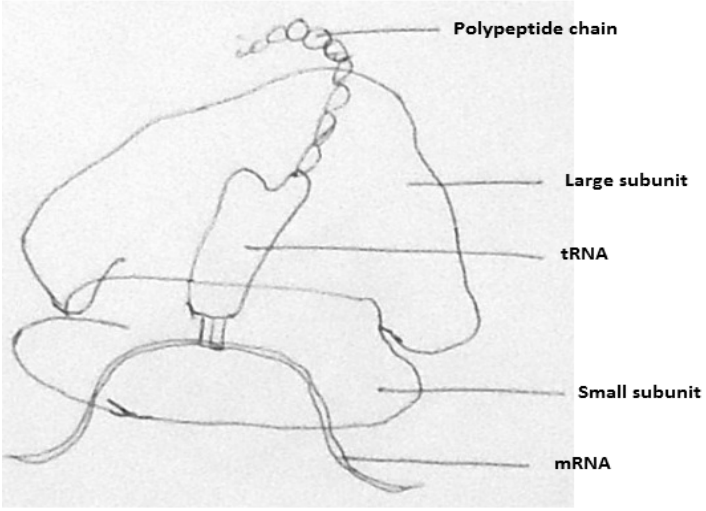
Marks 8

I. **Ribosomes**
II. **Mitochondria**
III. **Plastids**

Solution:

I. **Ribosomes**

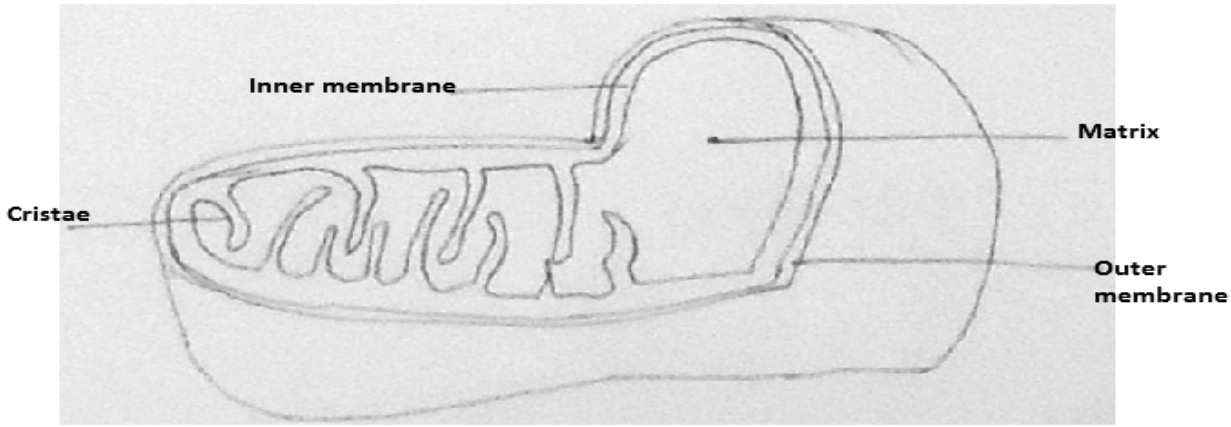
Ribosomes are the protein making machinery of the cells. These are present free in cytoplasm or attached to endoplasmic reticulum. A large number of ribosomes are present in cells. Eukaryotic ribosomes are slightly different than prokaryotic ones in their size.



Structure of a ribosome

I. Mitochondria

Mitochondria are called power house of the cell. These make energy for the cells in the form of ATP (Adenosine Tri Phosphate). ATP is the biological or chemical form of energy. Mitochondria have a double membrane, one is called outer and the other is inner membrane. Mitochondria are filled with matrix containing circular DNA molecule and other molecules including the enzymes. Mitochondria are self-replicating organelles.



Mitochondria

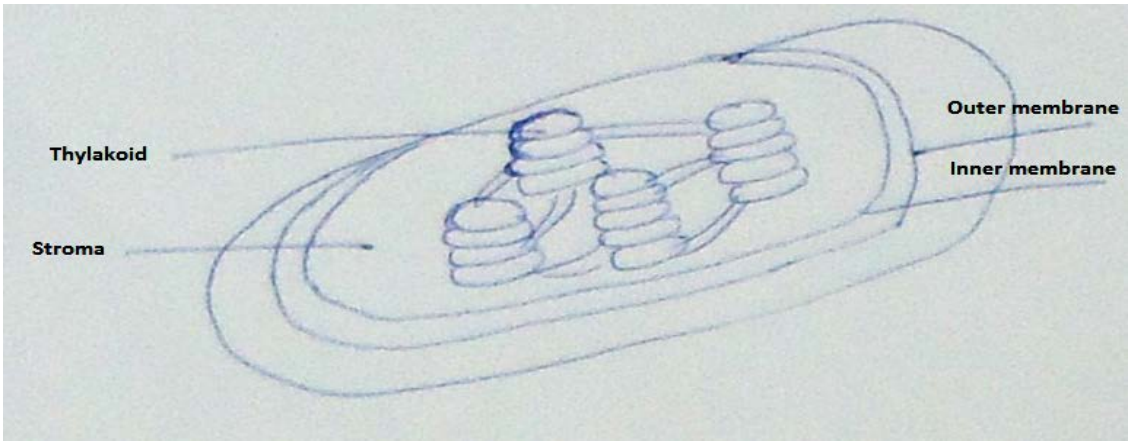
II. Plastids

Plastids are the double membrane bound organelles, present in plants and in the other organisms which are producers such as algae. These are of three main types:

- Chloroplasts are present in the green parts of plants. These are green in color and their color is due to chlorophyll, the green pigment. These help in photosynthesis.

- Chromoplasts are the organelles present in the fruits and flowers of the plants. Beautiful colors of fruits and flowers are due to presence of Chromoplasts which contain red, yellow, orange and more colored pigments.
- Lecuoplasts are the plastids present in the roots and tubers. These are colorless pigments and their function is to store various materials in the roots and tubers, e.g., potatoes.

Plastids have a double membrane system. Their membranes are called outer membrane and inner membrane. They have a membrane system called thylakoid. Stacks thylakoids are called grana. They have a matrix inside inner membrane which is called stroma. These organelles like mitochondria have their own circular DNA. These are self-replicating organelles.



Structure of a chloroplast (a kind of plastid)

Question No. 4

Write the name of the various events of Meiosis II and also explain the process of this division in male and female. **Marks 6**

Solution:

Events of Meiosis II

- Karyokinesis
  - Prophase II
  - Metaphase II
  - Anaphase II
  - Telophase II
- Cytokinesis
  - Each cell divides into two cells.

At the end of meiosis each cell divides into 4 haploid cells.

This division is different in males and females. In females, after first meiotic division (meiosis I), cytoplasm is unequally distributed and one large and other small cell are produced. The small cell is called a polar body. Then both of these cells carry out meiosis II. Polar body divides into 2 polar bodies. The large cell however is divided into one ovum (large) and another polar body. So that meiosis results into 1 ovum and 3 polar bodies .In males, both meiotic divisions results into equal sized cells called sperms.