SPM 2017
SCIENCE
EXAM TIPS
(NOTA TAMBAHAN
untuk KERTAS 1)

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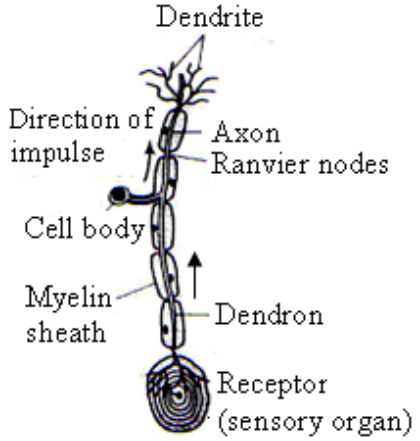
HURRY ORDER
The real Exam Tips with sample Questions
and model answers

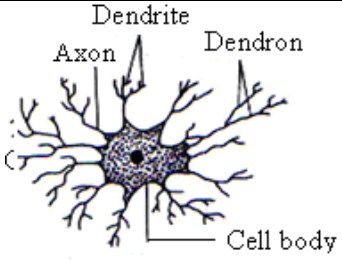
8. **Neurone / nerve cell**
   - Is the basic functional unit of the nervous system.
   - To receive and transmit nervous impulses.

a. **Sensory neurons**



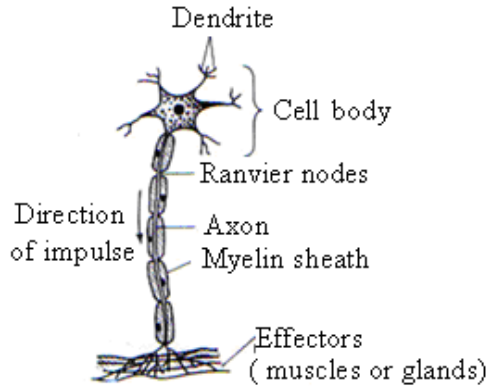
- Transmit nerve impulses from receptors to the central nervous system.
- Has a short axon

b. **Relay neurons**



- Transmit impulse from sensory neurone to motor neurone.
- Connect sensory neurons with motor neurons.
- Found inside the central nervous system / spinal cord.

c. **Motor neurons**



- Transmit nerve impulse from the central nervous system to the effectors which are muscle or glands **2009**.
- Have long axons to send nerve impulses to the effectors.

9 a. **Cell body**
   - Control and activity of the neuron.

b. **Dendrites and Dendrons.**
   i. Received impulses and
   ii. Send impulses to the cell body.

c. **Axons**
   - Carry nerves impulse along the nerve.

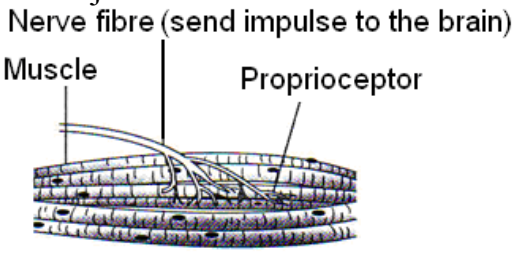
d. **Myelin Sheath**
   - Insulates, protect axon and speed up the transmission rate of nerve impulses along the nerve fibre.

10. **Kinaesthesis Sense**

a. contains proprioceptor / stretch receptors found in muscle, ligaments, tendons and joints.
   i. To maintain the body balance and coordination without looking at.
   ii. Detect the movement, change of position, muscle stretching, contraction or twisting.

b. *Example,*
   i. Walking on rope by an acrobat
   ii. Buttoning shirt, cycling.
   iii. Tying shoe string
   iv. Typing, clapping or walking up stairs.

v. Estimate the weight or length of an object

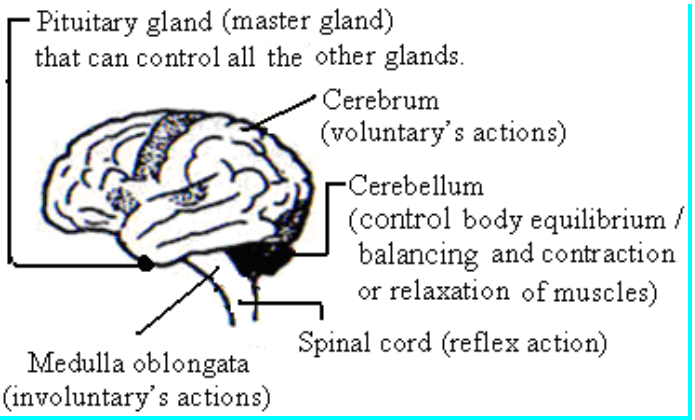


Proprioceptor

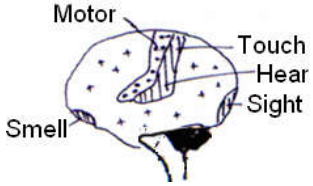
2.5 Differences between voluntary actions and involuntary actions.

Voluntary actions	Involuntary actions
- Under conscious control based on our needs. - Learning is required.	- Not under conscious control (automatic). - No learning is required.
- The same stimulus may lead to different response depending on different situations.	- The same stimulus always produces the same response.
- Controlled by the **cerebrum**.	- Controlled by the **medulla oblongata** or spinal cord.
- Can be quickened or slowered down.	- Can't be quickened or slowered down
- eg: writing, speaking, reading and dancing.	- eg: heartbeat, breathing, yawning, respiration digestion, growing.

2.6 Human Brain

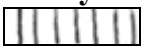
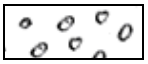
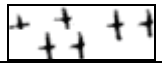


1. Protected by cranium.
2. Outer layer is grey matter which consists of cell bodies for the growth of the brain.
3. Inside is white matter which consists of nerve fibers (axons).
4. The brain is highly folded to increase the surface area **to pack more neurons**.
5. Divided into right and left cerebral hemispheres which control opposite side of the body movements.
6. a. **Cerebrum**(biggest part)
   - Voluntary actions
   eg: Speaking, reading, walking, thinking, swimming



b. **Receptor**
↓
Sensory neurone
↓
Central neurone (Brain)
↓
Motor neurone
↓
Effectors (Muscle / Glands)

Cerebrum consist of:

i. **Sensory area** 	Touch, sight, smell, taste, hearing
ii. **Motor Area** 	Movement of muscle
iii. **Association area** 	Thinking, speech memory, reasoning, imagination.

c. **Cerebellum**
- Maintaining body posture, equilibrium or body balancing. Control contraction and relaxation of muscles.

d. **Medulla Oblongata**
- Controls in involuntary actions, e.g. heartbeat, breathing, circulation of blood, peristalsis, swallowing, growing, digestion and respiration, yawning.
- If injured, the person will die.

5. **Body coordination** – to coordinate body's responses towards stimuli

Body Coordination	
Nervous system	**Endocrine system**
a. SIMILARITY	
i. Carry out body's responses towards stimuli. ii. Both involve four component; stimulus, receptor, effector and response. iii. Coordinate all body activities and responses iv. Ensure survival of life	
b. DIFFERENCES	
i. Consists of the brain, spinal cord and neurons / nerves. ii. In the form of electric impulses. iii. Comes from inside and outside the body. iv. Fast and often does not last long. v. Normally localized like the organs and glands vi. No feedback mechanism.	i. Consists of endocrine / ductless glands . ii. In form of chemicals known as hormones in the bloods. iii. Comes from inside the body. iv. Most of them are slow and long lasting. v. Normally widespread and covers the whole body. vi. Has feedback mechanism and response.

FORM 4 CHAPTER 3 HEREDITY AND VARIATION

4. a. **Type of chromosomes** (46)

Autosomes 22pairs = 44 | Sex 1pairs = *x* / *y*

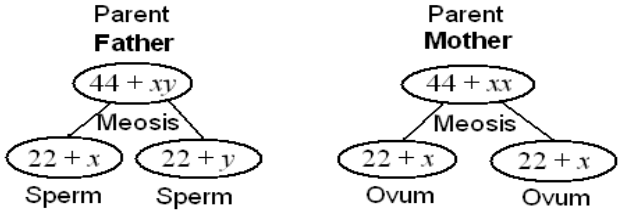
	Autosome		Sex		Total
Male	44	+	*xy*	=	46
Female	44	+	*xx*	=	46

b. **Chromosomes in Gametes**

sperm = 22 + *x* / 22 + *y*

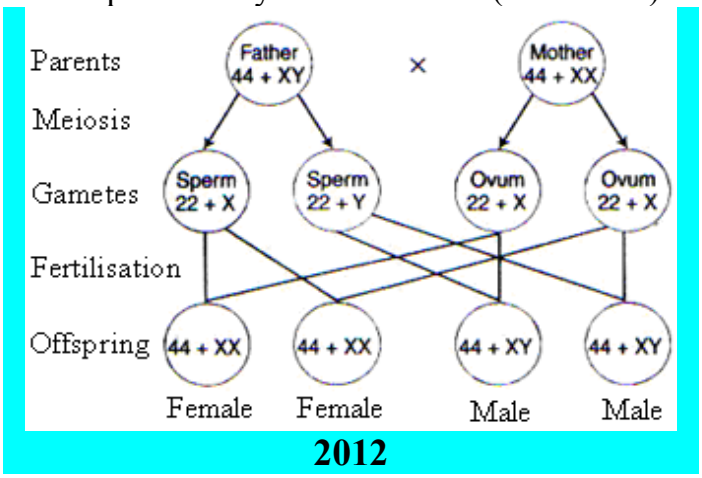
ovum = 22 + *x*

c.



5. **Sex of baby:**

a. The probability of having a male or female child is the 50% because half of the sperms carry *y* chromosome and half of other sperms carry *x* chromosome (Ratio 1 : 1)



b. The sex of the baby is determined by the sex chromosome in the sperm.

9. **Mutation**

a. is the sudden change to the structure of genes or **number** of chromosomes

b. can be caused by **mutagen** such as
   i. chemical substances (e.g. pesticide, nicotine in cigarettes, drugs, nitrogenous acid, preservatives, colouring or artificial sweetener)
   ii. **radioactive radiation** (gamma ray, ultraviolet, *x*-ray)
   iii. temperature (too high or low)

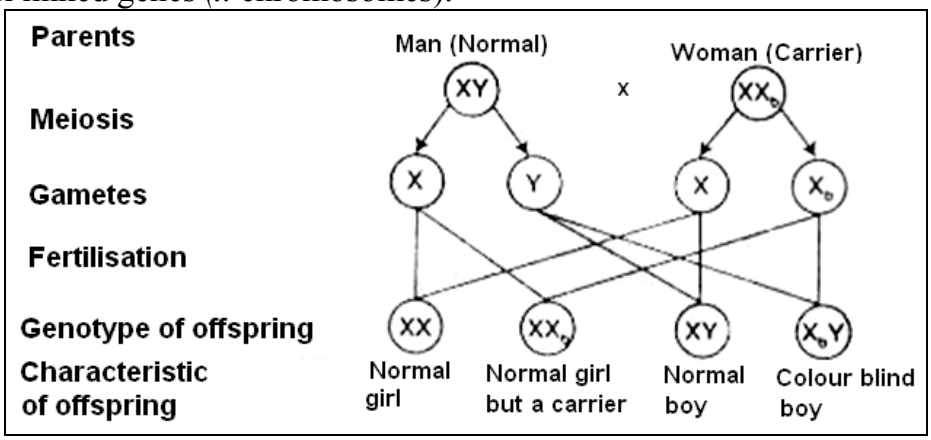
c. **Advantages**
   i. cause variation to enable organism to adapt to the environment (more resistant to diseases, weather or pollutant)
   ii. creation of new species.

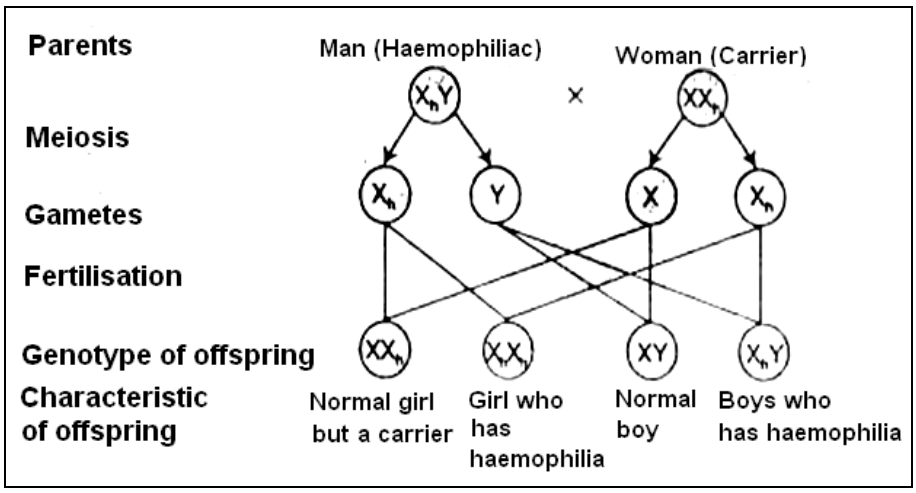
d. **Disadvantages**
   - cause diseases (colour blindness, haemophilia, anaemia or klinefelter's syndrome, polydactyl trait)

Hereditary Diseases caused by	
e. Mutation Gene	**f. Mutation Chromosomes**
- change in the structure of gene in the chromosomes *x* of the recessive gene by mutagen. - eg. a. **albinism** b. **haemophilia** (blood unable to clog) *c.* **anaemia**. d. **colour blindness** (unable to differentiate between red and green)	- changes in the number of chromosomes by mutagen. i. eg. **Down's syndrome** (has small slanting; mentally retarted and square face) (47 chromosomes) presence of one extra chromosomes at the 21st pair of chromosome. ii. **Klinefelter's syndrome (**has small testis and sterile) (47 chromosomes) presence of one extra *x* (44 + *xxy*) chromosome at the sex chromosome (*xxy* in the male) iii. **Turner's syndrome** (45 chromosomes) lacks one *x* chromosome (*xo* in the female) (44 + *ox*). Secondary sexual characteristic fail to develop.

10. **Genetic Engineering** is to improve the quantity and quality of **Crops / livestock**
   a. In Medicine - to identify heredity / sex – linked disease.
   b. In Agriculture- : i. Improve the quality of breeds
      ii. Bring in new species with higher resistance to disease or pests or environment
      iii. Increase production

11. **Medicine**
   - Most heredity disease like colour blindness, haemophilia and albinism are caused by recessive genes or sex linked genes *(x* chromosomes).





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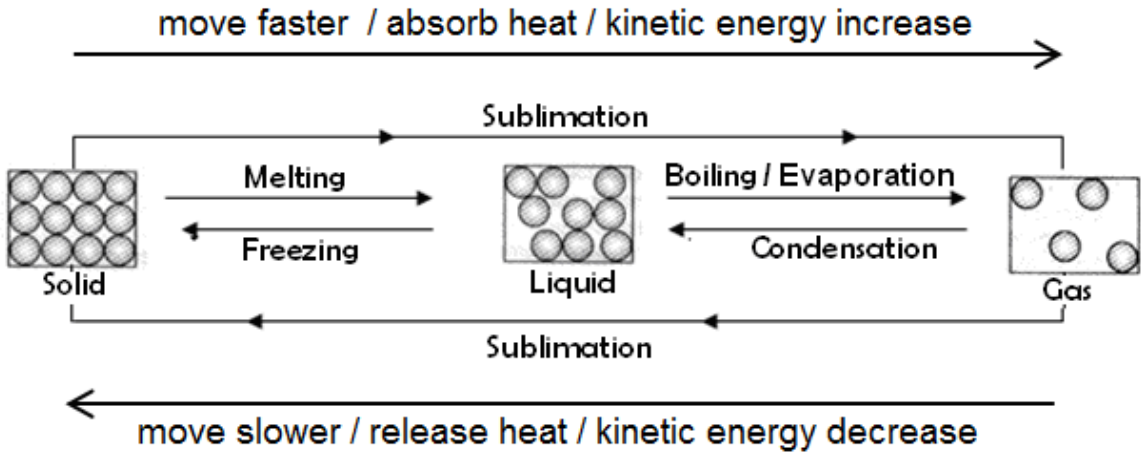


Solid	Liquid	Gas
i. Particles **are arranged closely** and **orderly** in **fixed positions**. ii. Cannot be compressed. iii. Vibrates at their fixed positions. iv. Attraction forces are very **strong** **v.** Kinetic energy is very low	i. Particles are not orderly arranged ii. Cannot be compressed. iii. Particles keep contact with one another with spaces between particles. iv. Move freely v. Attraction forces is **weak**. vi. **Kinetic energy is higher**.	i. Particles **are further apart** ii. Move freely in random in all direction. iii. Attraction force is **very weak** and compressible (because they are far apart). iv. Kinetic energy is the highest.

14. a. **Characteristic or Properties of Metals and Non-Metals**

Metal	Non-Metal
a. **Shinny** and lustrous	a. Dull
b. **Ductile;** can be pulled into a wire.	b. Brittle or fragile and breaks easily
c. **Malleable;** can be beaten into thin sheet because atoms in metal can slide over one another easily.	c. Not malleable
d. **Tensile;** very strong because of strong metallic bonding.	d. Weak and snaps easily
e. **Good conductor** of electricity because of free electrons.	e. Insulator
f. **Good conductor** of heat.	f. Poor conductor of heat
g. Very **dense** because atoms in metal are closely packed.	g. Low density
h. Very high boiling and melting points because of very strong atomic / metallic bonding.	h. Low boiling or melting points because of weak Van der Waal force.
i. e.g. iron, gold, copper, aluminium, zinc.	i. e.g. sulphur, glass, chlorine, sulphur and diamond.
j. **Aluminium** is used as food wrapper.	j. Diamond is very hard and used to cut glass.
k. **Gold** is used to make jewellery because malleable (easily slide over one another), shinny and non-rusting.	

b. **Pure Substances**

i. **Distilled water** is pure water because it does not contain any dissolve substance or foreign matter.

ii. The boiling point of pure water is 100^0C and melting point is 0^0C.

iii. However **impurities** such as salt can **increase the boiling point** to 102^0C and lower the **melting** / **freezing** point to -2^0C.

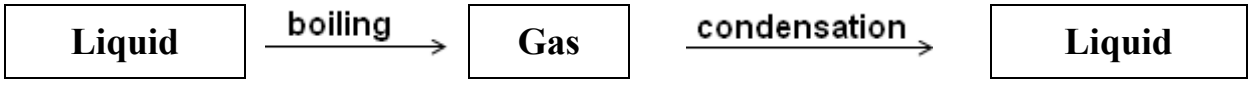
iv. Ice-cream hawkers add salt into the ice box to lower the melting point of ice to prevent the ice cream from **melting too quickly**.

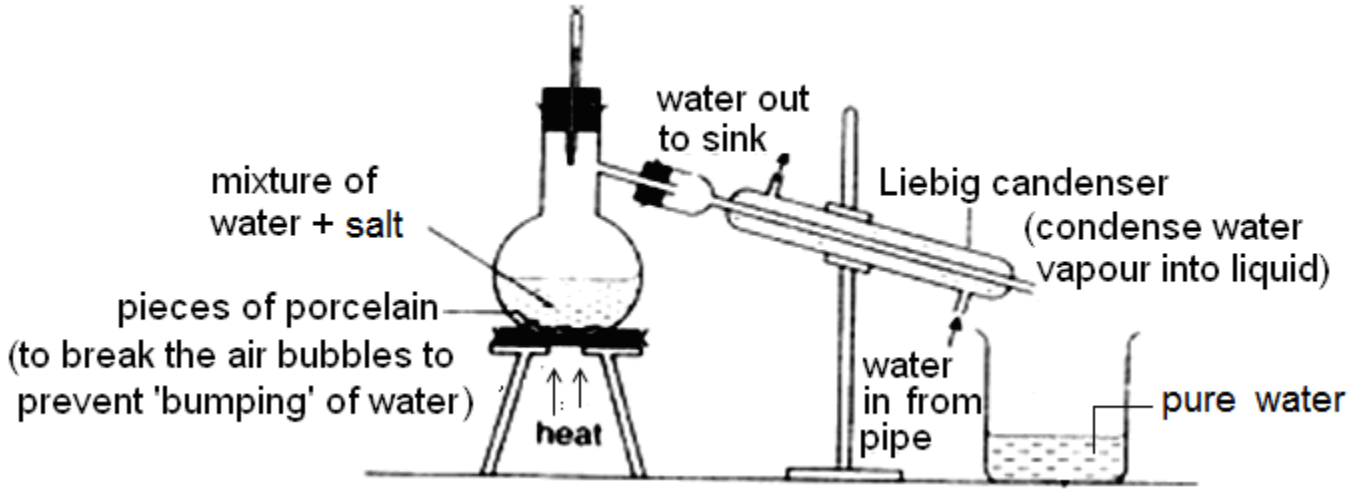
v. Workers add salt on the road during winter to prevent the snow from melting too quickly.

16.a. **Purifying Substances**

Distillation (to obtain **pure liquid**)

- Is the process of **boiling** the liquid and **condensing** the vapour into **pure liquid**.



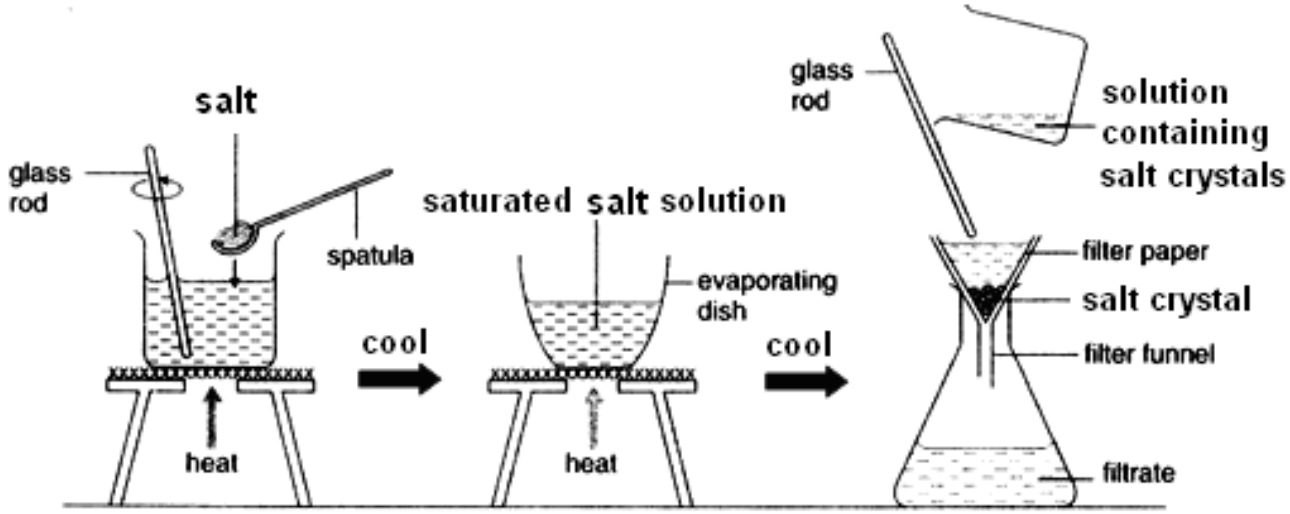


Distillation of salt water

Note: *Mixture of water and salt can be separated by distillation as they have different boiling point.*

b. **Crystallisation** (to obtain **pure solid / salt / sugar**)
- Is forming of pure sugar crystal from a hot **saturated solution** of a sugar when it is cooled.
- e.g. mining **salt** (sodium chloride) from sea water / obtaining sugar from sugar solution / solid copper sulphate.

Obtaining pure salt crystal



2. Heat change in Chemical Reaction

a. **Exothermic reaction** (releasing heat to form bond)	b. **Endothermic reaction** (absorb heat to break bond)
- Surrounding temperature increase - **Examples**: Temperature of the solution rise when Sodium hydroxide crystals dissolve into water i. magnesium ribbon is burned in air ii. calcium hydroxide or zinc reacts with dilute hydrochloric acid iii. concentrated sulphuric acid is dissolved in water	- Absorb heat to break bonds. - Surrounding temperature lowered - **Examples:** i. solid Ammonium Chloride is dissolved in water ii. solid Potassium Nitrate dissolved in water iii. reaction of Zinc and Copper Sulphate

3. Reactivity Series of Metals

a.

Very reactive ↑	Potassium, Sodium, Calcium, Magnesium, Aluminium	React with water / React with steam → to produce alkali + hydrogen	React with oxygen → metal oxide
Less reactive ↓	Zinc, Iron, Lead, Tin, Copper	React with acid → salt + hydrogen	
Non-reactive	Mercury, Silver, Platinum, Gold	Free pure elements	

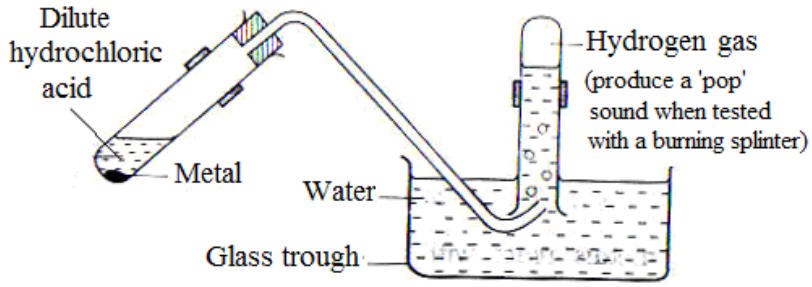
b.

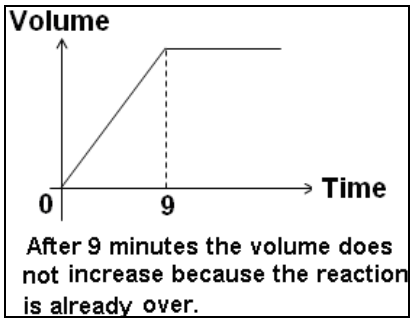
Metal	+	Water / steam	→	Alkali	+	Hydrogen
Magnesium	+	Water	→	Magnesium hydroxide	+	Hydrogen
Aluminium	+	Steam	→	Aluminium oxide	+	Hydrogen

* more reactive metal produce more hydrogen

c.

Reactivity of metal with acid/water





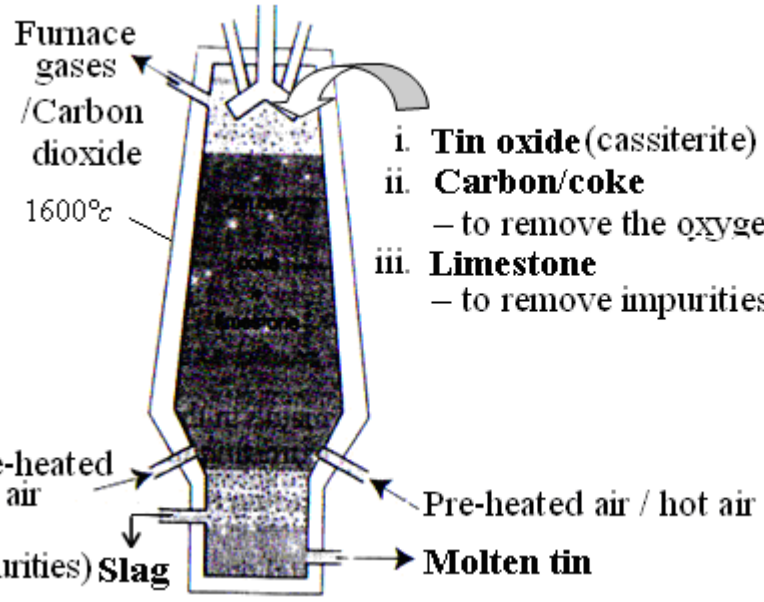
Relationship:
The volume of gas increase with time.

Metal	+	Acid	→	Salt	+	Hydrogen
Zinc	+	Sulphuric acid	→	Zinc sulphate	+	Hydrogen
Iron	+	Hydrochloric acid	→	Iron chloride	+	Hydrogen

i. **Aim:** To determine the reactivity of different metal with acid
ii. **Hypothesis**: Zinc produces more hydrogen gas than iron and copper.
Variables:
iii. Manipulated variable: type of metal
iv. Responding variable: volume of gas collected
v. Constant variable: mass of metal / volume of acid
vi. **Inference**: Zinc is more reactive then iron and copper
vii. **Operational definition of**
viii. **Rate of reactivity:** Volume of gas collected
ix. **Conclusion:** Difference metal has different rate of reactivity with acid

b.ii. **Extraction of metal by carbon located below carbon in the reactivity series are extracted by the reduction method by carbon**, such as Zinc, Iron, Tin, Lead, and Copper.

Tin Oxide + **Carbon** ⟶ **Tin** + **Carbon dioxide**
(cassiterite) (coke) (pure)



i. **Tin oxide** (cassiterite)
ii. **Carbon/coke**
– to remove the oxygen from the metal oxide.
iii. **Limestone**
– to remove impurities such as sand as slag.

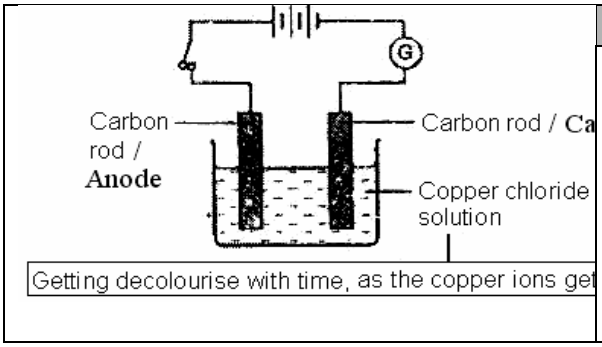
Note: Advantages of using carbon is:
i) economical
ii) easily available

Blast Furnace

iii. Carbon is used because carbon is more reactive than tin.

Electrolysis	Break compound into its elements using electricity (Electric energy ⟶ Chemical energy)

1 a. **Electrolysis of Copper Chloride Solution**

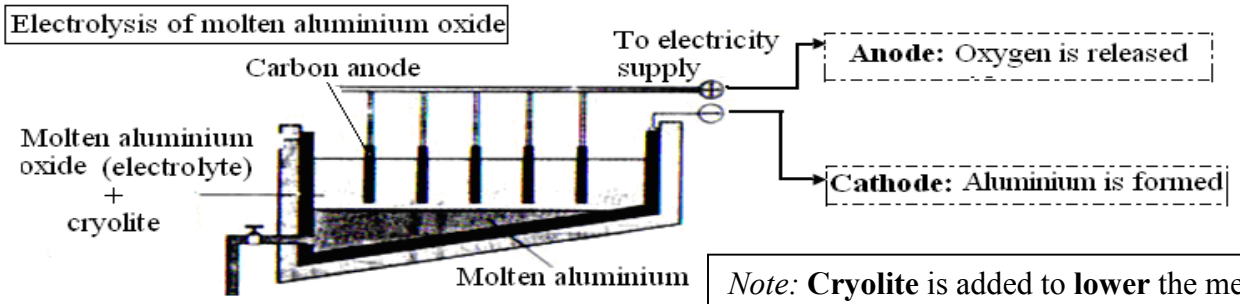


Anode	Cathode
- Chloride gas is produced./turn damp litmus paper into red - Chlorine ions release electrons to become chlorine atoms - $Cl^- - e \rightarrow Cl$	- Copper is deposited. - Copper ions receive electrons to become copper atoms - $Cu^+ + e^- \rightarrow Cu$

b. **Electrolysis used for**

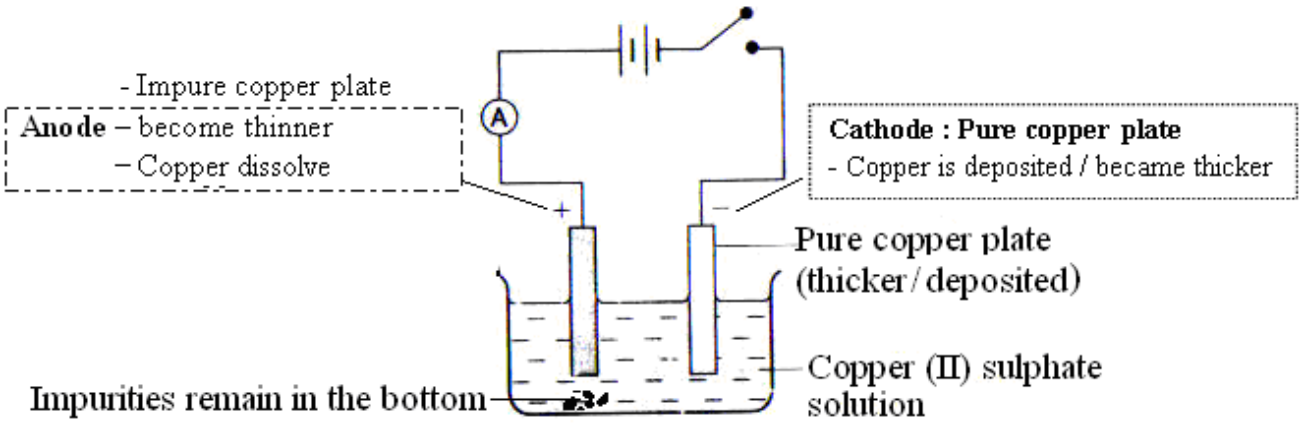
i. Extraction of metals
ii. Purification of metals
iii. Electroplating of metals

2a. **Extraction of Metals** (Aluminium from bauxite)



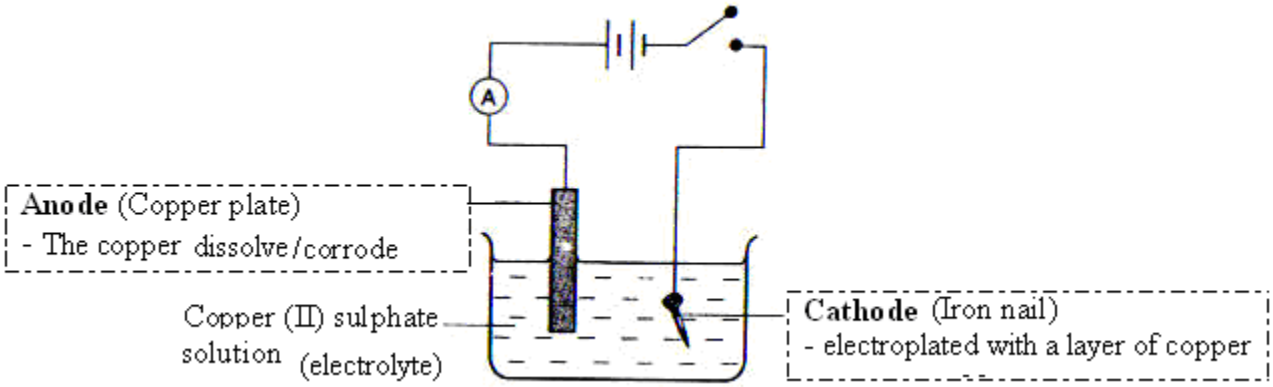
Note: **Cryolite** is added to **lower** the melting point of the bauxite.

b. **Purification of metals** (Purification of copper)



***Note:* (i) The solution must contains the ionic which is **same** as the metal of the anode plate.
(ii) Copper (ll) sulphate solutions colour remain because the copper ions that deposited onto the cathode is replaced by copper ions that dissolved from anode

c. **Electroplating of Metals** (Electroplating iron nail with copper)

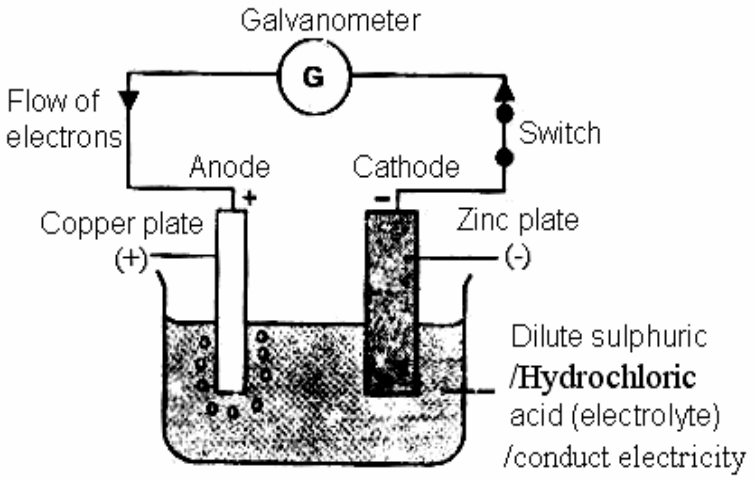


**Note:* Copper (ll) sulphate solutions colour unchanged because the copper ions that deposited onto the cathode is replaced by copper ions that dissolved from the anode.

i. **The aims / advantage of electroplating**:
   a) Prevent the metal from corrosion (rusting)
   b) Make the metal look more attractive
ii. **The following methods should be taken into consideration to obtain a good quality and attractive electroplated product**.
   a) The surface of the metal to be plated must be clean by sand paper beforehand.
   b) Electric current supplied should not be too big
   c) Dilute electrolyte should be used.
   d) The period of electroplating should take a longer time.
   e) The nail must be rotated slowly.
iii. The metal used in anode must same with the metal compound solution.
iv. The electrolyte must has same type of metal ion with the anode

Electrical Energy from Chemical Reaction

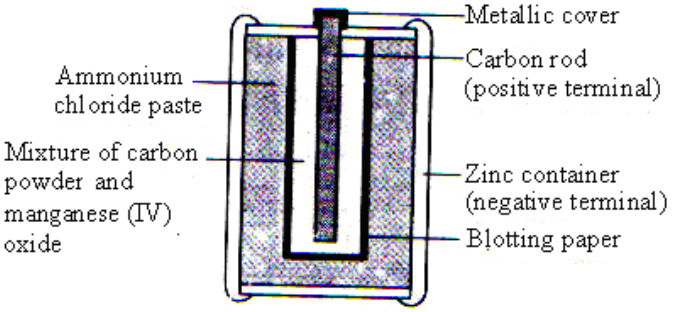
1. **Simple cell**
   (Chemical energy ⟶ Electrical energy)
   i. The less reactive metal like **copper** is made the positive electrode (anode).
   ii. The more reactive metals like **zinc** is made the negative electrode (cathode) because this metal is more likely release electrons to form ions.
   iii. No electricity is produced when both metals are the same.
   iv. The further the metals apart, the higher the voltage/current is produced.



2.

Cells	
Primary	**Secondary**
- Non-rechargeable. - eg: a. dry alkaline battery (used in torch light) b. silver-oxide mercury battery (used in watches/calculators)	- Rechargeable. - eg: a. lead acid accumulators (used in car) b. nickel-cadmium battery (used in handphone)

3. a. **Dry Cell/Alkaline bateries – used in torch light / portable radio.**



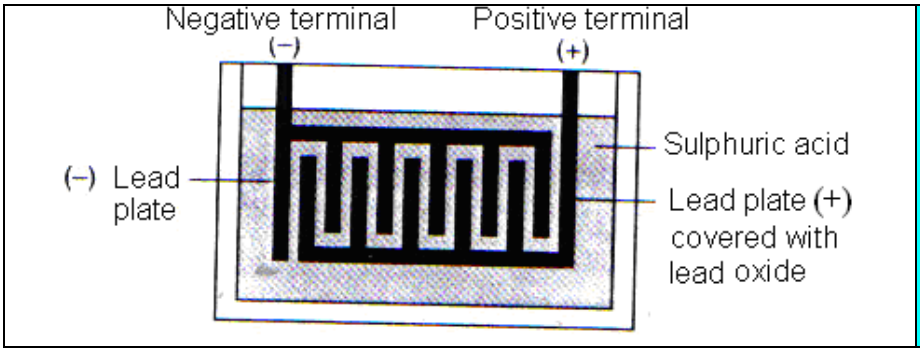
Cross section of a dry cell

i. **Ammonium chloride paste** as electrolyte.
ii. **Carbon powder** to reduce the resistance.
iii. **Manganese oxide** to oxidizes the hydrogen gas produced into water to reduce the polarisation of the cell.

b. **Advantages of dry cell**
- non-spill over
- small light and portable.

c. **Disadvantage**
- non- rechargeable.
- short life span.

4. **Lead - Acid Accumulator** (rechargeable) used in car.



Advantages
- produce a stable current
- produce higher voltage
- rechargeable
- last longer

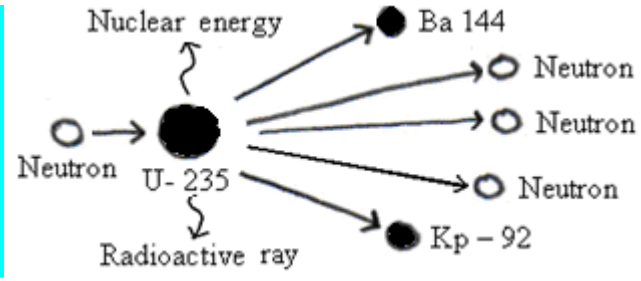
Disadvantage
- can spill over
- it is heavy

FORM 4 CHAPTER 6 NUCLEAR ENERGY

Nuclear Energy and its uses

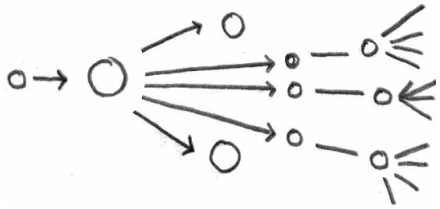
5. **Producing nuclear energy through**

a. **Nuclear fission**



- A high energy neutron bombards a uranium nuclease to s plit into two lighter nuclei with the release of three neutrons and heat or nuclear energy and radioactive rays.

b. **Chain reaction**
- Is continuous of nuclear fission



6. **Nuclear Fusion**
- Combination of two light nuclei to form a bigger nucleus with the release of energy

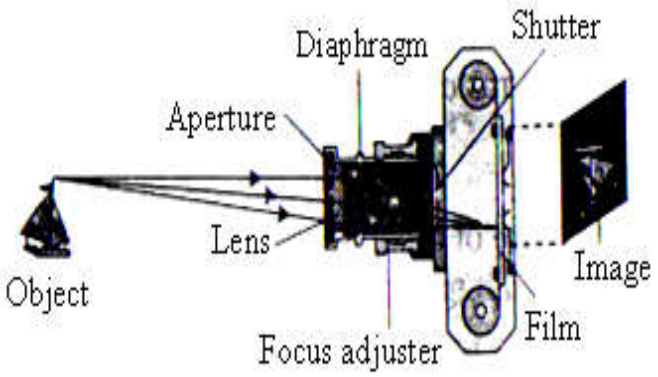
- Example: Two hydrogen atoms combine to form a helium atom with the releasing of nuclear energy in the core of the Sun.
- Occur naturally in the core of the Sun.

7. **Uses of Nuclear Energy**

- To produce electrical energy in a nuclear reactors using uranium.
- To move submarine / carrier
- To make nuclear bom

FORM 4 CHAPTER 7 LIGHT, COLOUR AND LIGHT

4. **Camera**



Ray diagram showing formation in a camera

		Function
a	Diaphragm	Control the amount of light
b	Aperture	Allow the light to enter
c	Shutter	Control the duration of light exposure
d	Focus adjuster	Adjust the position of the image on the film./ produce sharp image.
e	Film	Formation of image / capture image

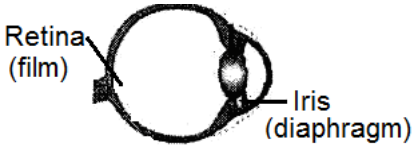


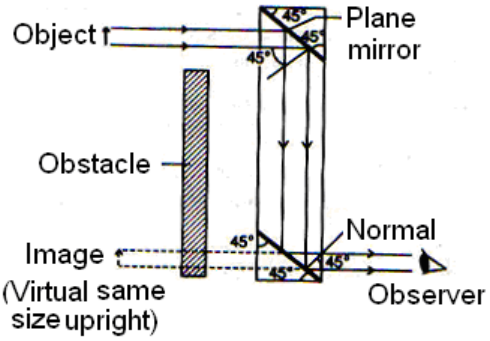
Image formation in an eye

5.

Type of image	
a) Real	**b) Virtual**
- eye - camera - **convex lens**	- microscope - telescope - mirror - periscope - magnifying glass - concave lens - convex lens

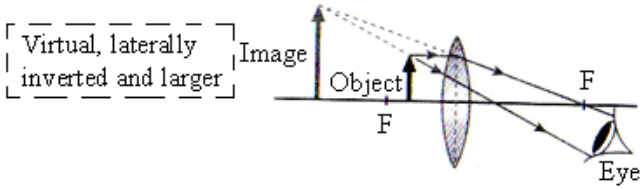
Formation of Image by Optical Instruments

1. **Mirror(reflection of light)**
   - **Periscope** in submarine, double-decker bus or too see over the wall.



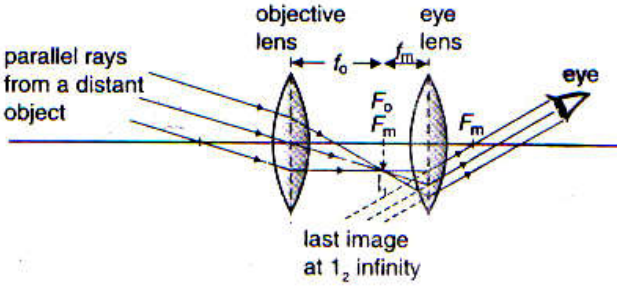
2. **Convex lens**

a. **Magnifying glass**



b. Telescope – the image is at infinity, virtual and inverted.

– $f_e < f_0$

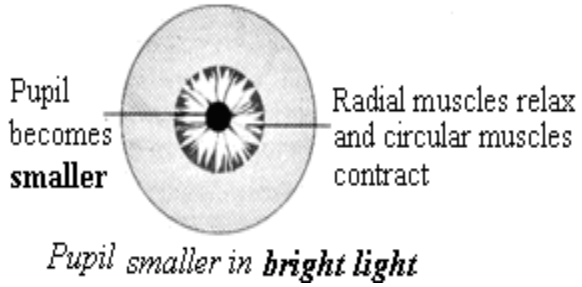


c. **Microscope** – the final image is virtual, inverted and enlarged.

- $f_0 < f_e$

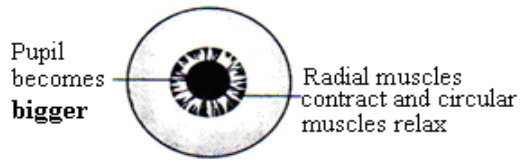
d. **Human eye** – image formed are real, inverted, and diminished.

i.

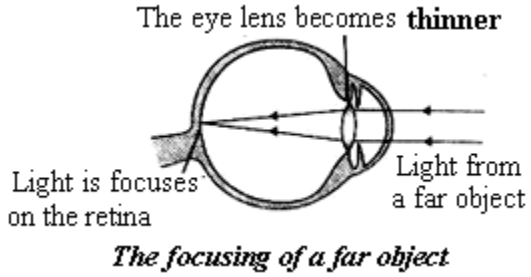


*Pupil smaller in **bright light***

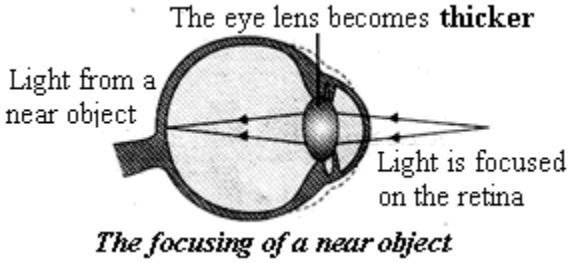
ii.



*Pupil bigger in **dim light***



The focusing of a far object

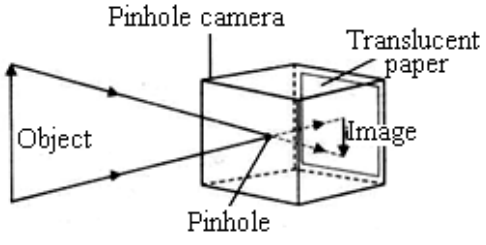


The focusing of a near object

e. **Camera**

- amount of light entering a camera depends on:
  i. The size of the aperture (diagram).
  ii. The shutter speed.
- **Image** formed:
  i. real,
  ii. upside down (inverted)
  iii. smaller size (diminished)
  iv. shorter image distance

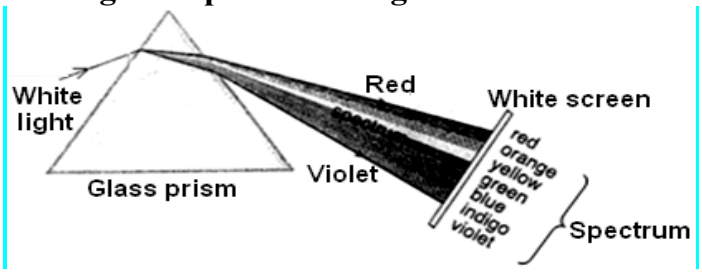
f. **Pin-hole Camera**



3. **Comparison between Human Eyes and Camera.**

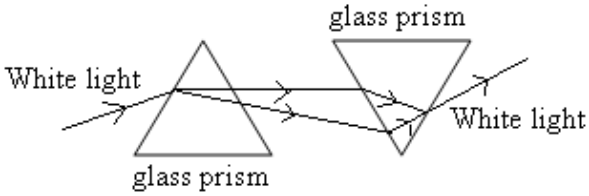
	Human Eyes	Camera
i.	Eye lens	convex lens
ii.	Iris	diaphragm
iii.	Pupil	aperture
iv.	Retina	film
v.	Ciliary muscles	focusing ring

4a. **Light Dispersion Using Prism**



i. White light disperses because white light consists of different light colours.
ii. which travel at different velocities
iii. refracted at different angles when dispersed by a glass prism**.**

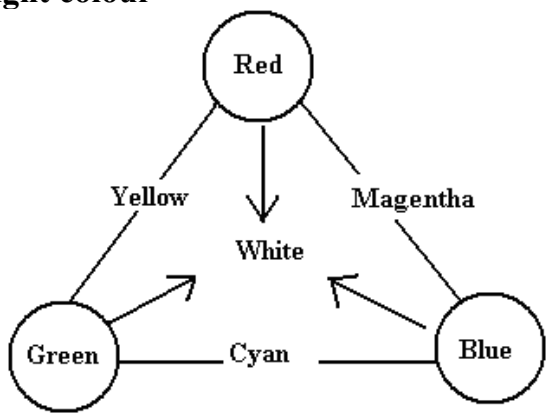
b. When the spectrum is combined, a white light is produced



c. **Natural phenomena of dispersion of light/** spectrum**..**

i. Rainbow
ii. Soap bubbles

5. **Light colour**



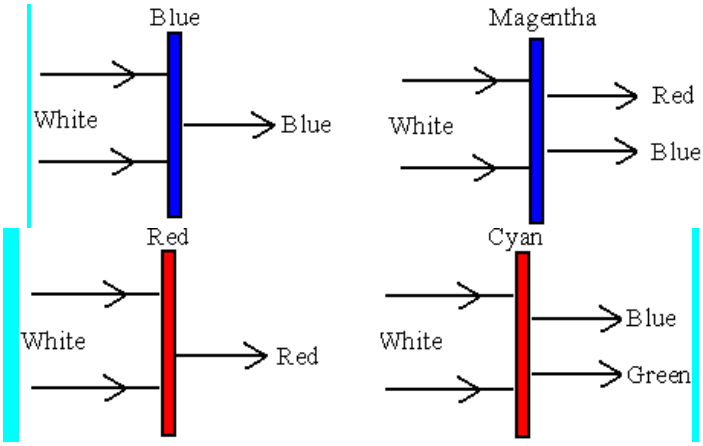
a. **Primary colours**
- Original colour that can't form by any combination of light colours.
- Red + Blue + Green = White

b. **Secondary colours**
- consists of two primary colours combined together.

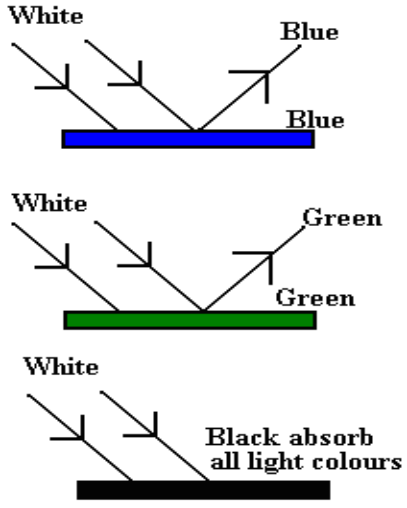
Primary + Primary → Secondary

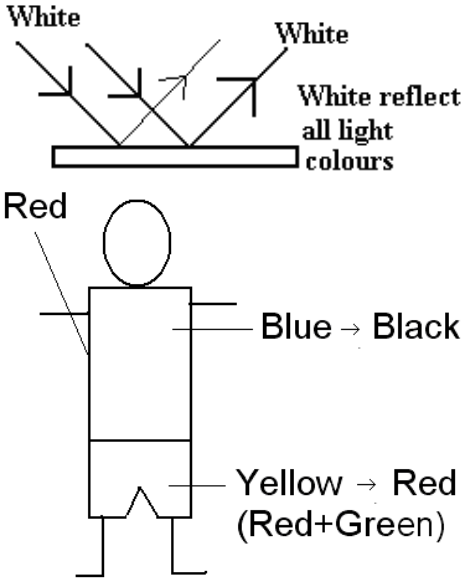
i. **Red + Blue → Magentha**
ii. **Red + Green → Yellow**
iii. **Blue + Green → Cyan**

6. **Colour filter**.
   a. Only allow light colour which is **same** colour to pass through.
   b. Other colours are absorbed



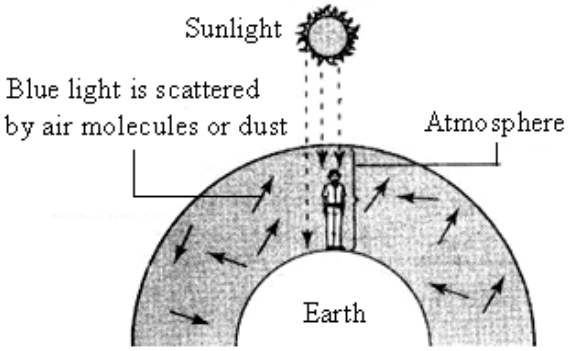
7. **Colour object**
   a. Only reflect light colour which is **same** colour with the object
   b. Other colours are absorbed



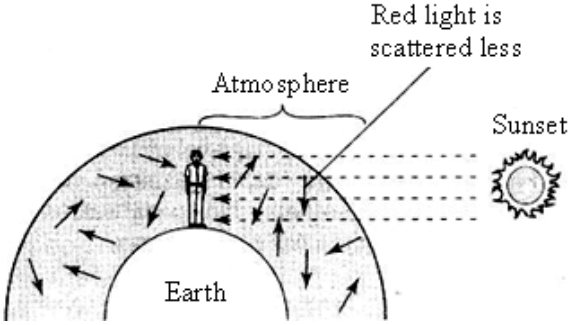


8. **Phenomenon of Scattering of light**

a. Sky looked blue
- The blue, indigo and violet lights are scattered by air molecules to the sky causing the sky looked blue.



b. Sunrise / sunset looked reddish in colour
- The blue, indigo and violet lights are scattered by air molecules. Only red and yellow lights reach our eyes make the sunset / sunrise looked reddish in colour.



9. **Formation of rainbow (light dispersion)**
- After raining, the water droplets in the atmosphere act as glass prism and dispersed

the sunlight to form a spectrum of light called rainbow.

10. Important of colour
    - make peacock has colourful feather to attract mate
    - lizard can camouflage itself same colour as surrounding colour
    - to protect themselves from enemy.

FORM 5 CHAPTER 2 NUTRITION AND FOOD PRODUCTION

NUTRITION AND GOOD EATING HABIT

1. **Calorific value**.
   - Is the energy content of a food / energy produced when 1 g of food completely burnt in air.
   - Can be measured by using a Bomb Calorimeter.

2a. **Calorific value of**

i. Carbohydrates = $17.2 kJ\,g^{-1}$

ii. Protein = $22.2 kJ\,g^{-1}$

iii. Fats = $38.5 kJ\,g^{-1}$ (2 x carbohydrates) (highest calorific value)

1 calorie = heat required to rise 1 g of water to 1°C

Vegetables, vitamins, water and minerals do not contain any energy at all.

b. A pupil takes 20g of bread and 100g of milk. What is the total energy consumed?

Answer:

Bread: $20g \times 17.2 kJg^{-1} = 344 kJ$

Milk : $100g \times 22.2 kJg^{-1} = 2220 kJ$

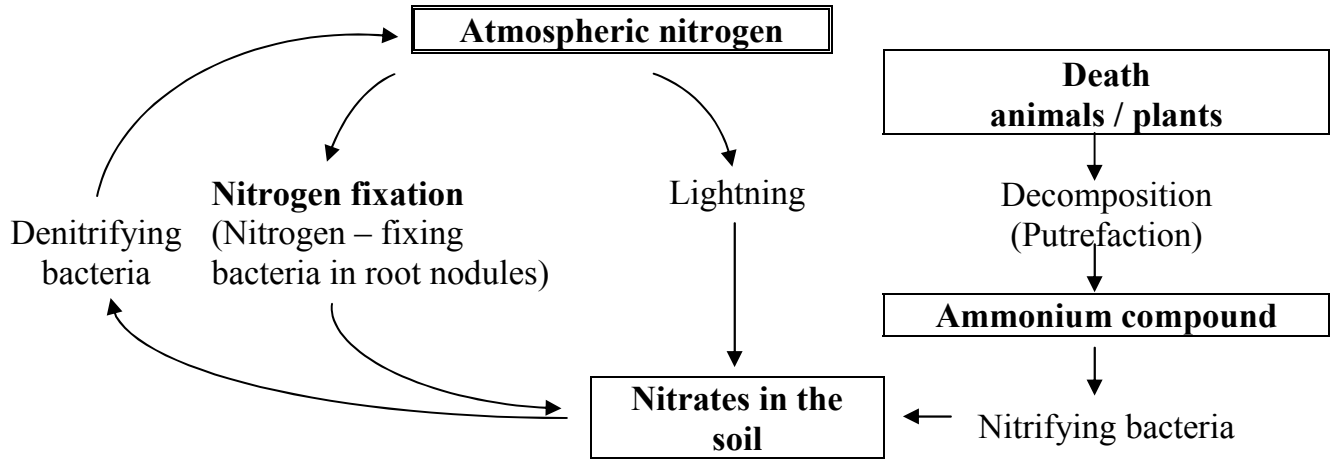
Total = <u>2564 *kJ*</u>

FORM 5 CHAPTER 3 PRESERVATION AND CONSERVATION OF THE ENVIRONMENT

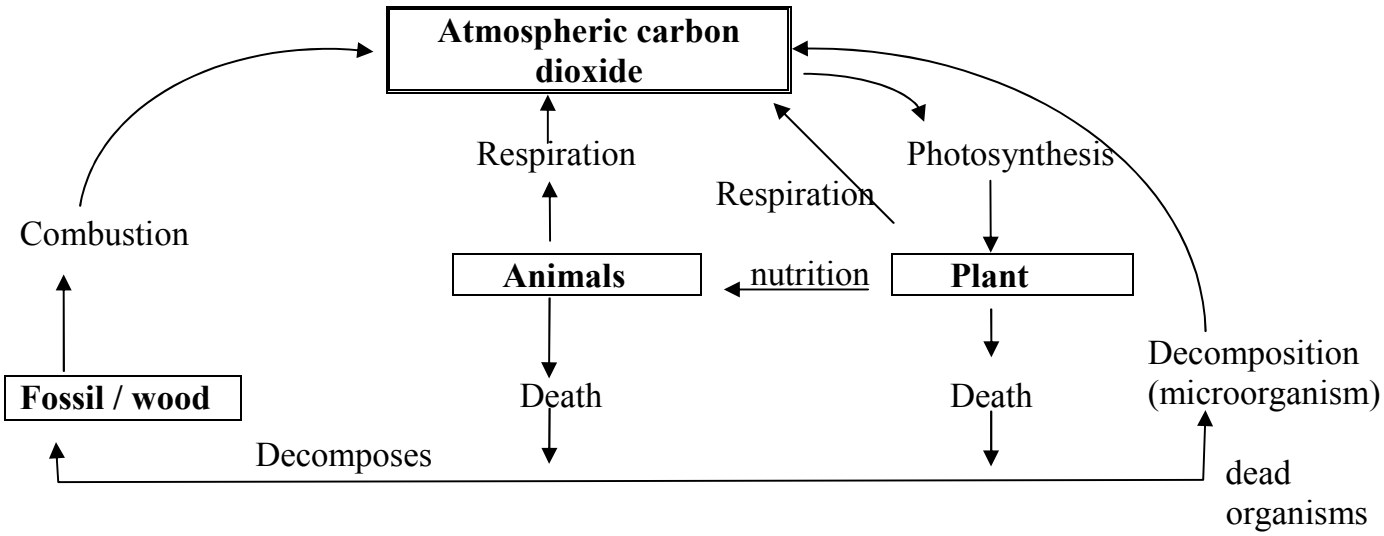
1. **Natural cycles include**

a. Nitrogen cycle b. Carbon cycle c. Water cycle

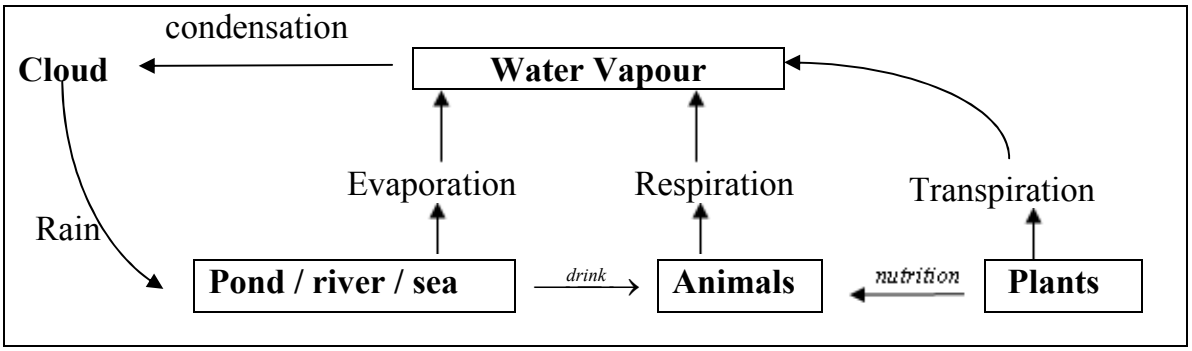
2a. **Nitrogen cycle**



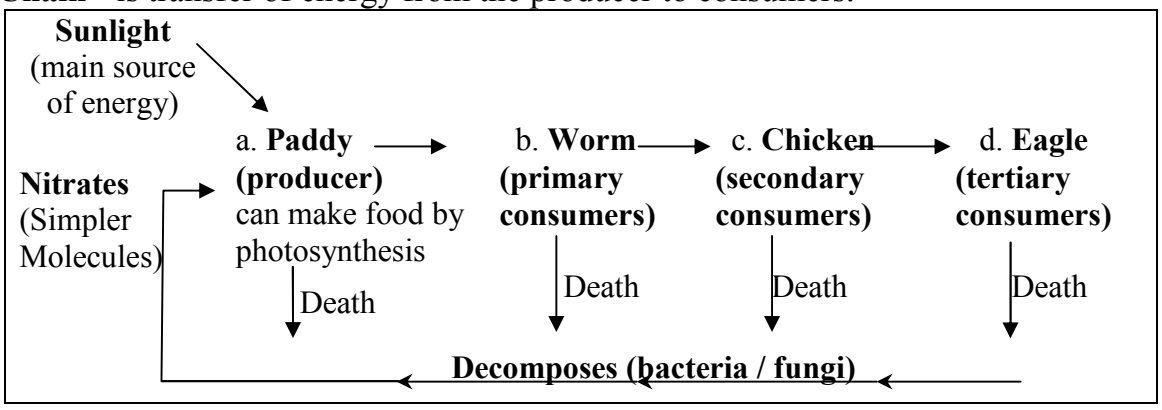
b. **Carbon cycle**



c. **Water cycle**



3. **Food Chain -** is transfer of energy from the producer to consumers.



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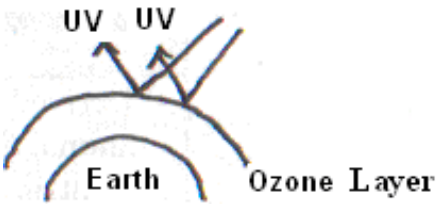
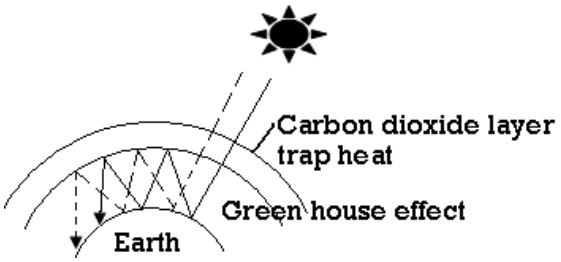
a. **greenhouse effect**
   i. Reduce extensive logging and land clearing. **Encourage tree replanting** / reforestation
   ii. Reduce vehicles on the road
   iii. Fix filter on the chimney
   - use public transport
   - practice car-pool system
   - use unleaded petrol
   - recycle of rubbish
   - use biological control of pest.

7. **Ozone**



a. consists of three oxygen atoms
b. protect the earth from harmful ultraviolet
c. can be depleted by chlorofluorocarbon (CFC)

8. **Chlorofluorocarbon (CFC)**
   a. it chlorine atoms set free when chlorofluorocarbon exposed to ultraviolet rays.
   b. these chlorine atoms deplete the ozone molecules
9. **Effects of ultra violet rays caused:**
   a. skin cancer
   b. eye cataract / mutation
   c. weakens body immune system
      destroy phytoplankton / kill algae which is food for fish/extinction of aquatic life
   d. cause ecosystem unbalanced / global warming
10. **Effort to save ozone layer**
    - replace *CFC* with *HFC*
11. **Greenhouse effect** – caused by carbon dioxide.



Carbon dioxide
- trap heat in our atmosphere and cause **greenhouse effect** or **global warming**
- produced by burning of fossil fuel, exhaust from vehicles, extensive logging/deforestation due to urbanization, open burning or opening land.

12. **Effects of Greenhouse effect / Global warming**
    a. sea levels increase due to iceberg melting at the poles of the earth
    b. droughts which causes low yield of crops and famine
13. **Carbon monoxide**
    - from exhaust fumes of vehicles can reduce intake of oxygen to the brain.
14. **Sulphur dioxide, carbon dioxide and nitrogen dioxide** can cause acid rain which carrode buildings and roof-top.
15. **(Euthrophication Process)** Excessive chemical fertillser can dissolve into rain water and flow into pond cause algae to grow. When algae dies, it decays and reduces the amount at oxygen and cause the fish to die.
16. **Ways to increase fertility of soil**
    i. practice rotation planting
    ii. grow leguminous plants
    iii. practice alternate planting
    iv. use chemical / organic fertilizer.
17.

Type of pollution	Effect
Air pollution	Haze, bronchitis, asthmatic
Water pollution	Cholera, extinction of aquatic life
Sound pollution	Deafness

FORM 5 CHAPTERS 4 Carbon Compounds

1. **Carbon Compounds**
   a. **Carbon** – is a non-metallic element but conduct electric.
   b.

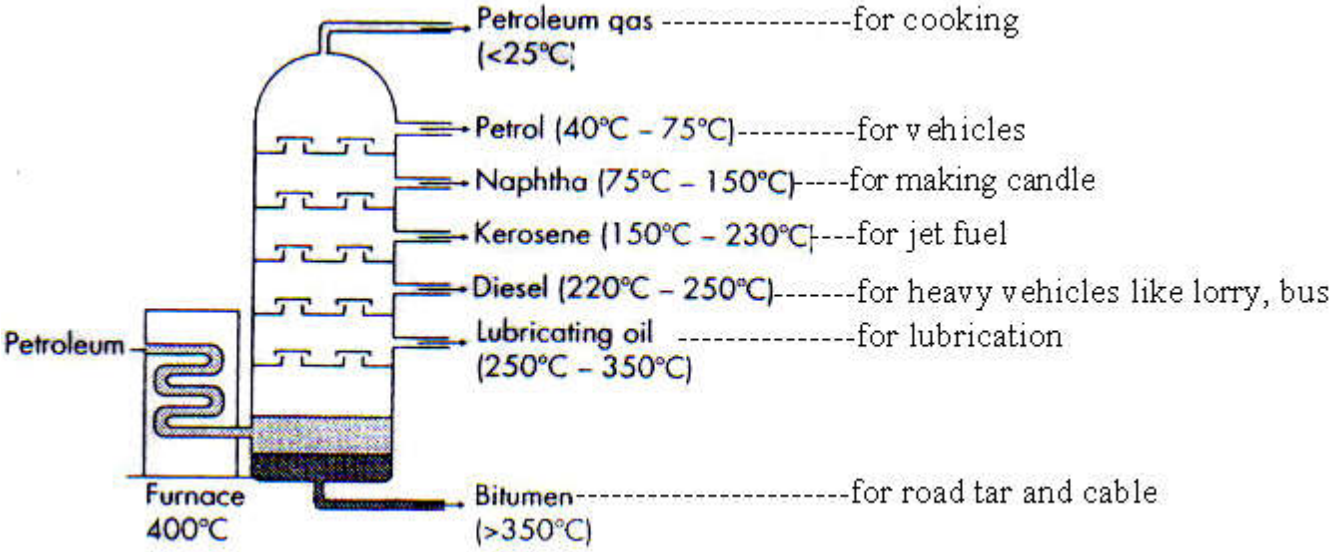
Carbon	
Diamond	**Graphite**
– hardest form of carbon – used to make jewellery – can cut glass	– soft and slippery – Used to make pencil's lead

c.

Carbon Compounds	
Organic	**Inorganic**
- Derived from **living things** (plants / animals) - Contain a lot of carbon atoms - e.g. $C_6H_{12}O_6$. - Dissolve in organic solvents such as ether, alcohol, petrol or chloroform. - Has low melting or boiling points. - e.g. alcohol, sugar, fats, protein, fossil fuels or hydrocarbon (petroleum, coal, natural gas).	- Derived from **minerals** in the earth. - Contains few carbon atoms - e.g. CO_2 . - Dissolve in inorganic solvents such as water, acids and alkalis. - Generally more stable with high melting / boiling points. - e.g. carbon dioxide, copper carbonate, calcium carbonate / lime stone / marble.

2. **Hydrocarbon**
   a. Consists of **hydrogen** and **carbon** elements only.
   b. Natural sources of hydrocarbons are **fossil fuels** such as:
      i. Coal
      ii. Natural gas such as ethane, butane, propane….
      iii. Petroleum

c. **Petroleum**
   i. Contains **a mixture** of hydrocarbons.
   ii. Can be separated by **fractional distillation** because each hydrocarbon **has different boiling points.**



iii. Fraction of petroleum and its uses.

Fraction	Main uses
1. **Petroleum gas**	- Fuel for cooking and making plastic.
2. **Petrol**	- Fuel for motorcycles, cars and aeroplanes (vehicles).
3. **Naphtha**	- Fuel for airplanes and making synthetic rubbers / candle.
4. **Kerosene**	- Fuel for jet planes and kerosene lamps and for making detergents.

↑ **Earlier fractions**
Lower boiling point
Less dense / lighter
Less viscous
Less yellowish
Less carbon / soot
Better fuels

5. **Diesel**	- Fuel for diesel engines and boilers.
6. **Lubricating oil**	- Engine lubricant and to make polish.
7. **Fuel oil**	- Fuel for ships and electrical generators.
8. **Paraffin**	- For making wax and polish.
9. **Bitumen**	- For covering roads and as a coating for underground pipes.

Later fractions
More dense / heavy
More viscous
More brownish
More carbon / soot
Higher boiling points

Fats – consists of carbon, hydrogen and oxygen.	
a. **Saturated**	b. **Unsaturated**
- contains maximum hydrogen atoms. - Mainly animal fats. - **Solid** in room temperature. - Raise **cholesterol** level. - Higher melting point. - e.g. butter, cheese**, ghee,** meat…..	- still can receive hydrogen atoms - Mainly plant oil. - **Liquid** form in room temperature. - **Cholesterol free** - e.g. palm oil, corn oil, peanut oil, soy oil, olive oil …….

10. **Hydrogenation process**

Unsaturated fat (plant oil) + Hydrogen → Saturated fats (margarine)

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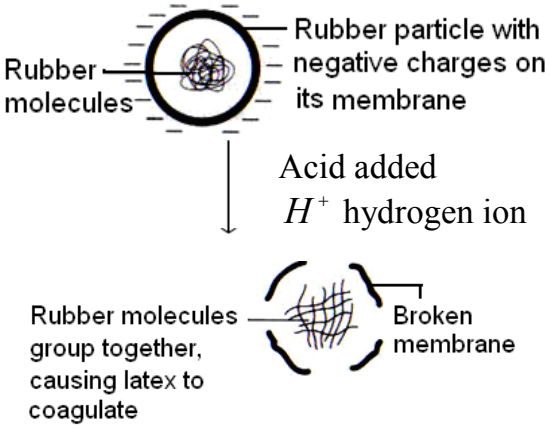
19. **Natural Rubber / latex**
    a. Polymer latex is formed from monomer isoprene
    b. **Properties of rubber / latex**
        i. soft, low melting point, not resistant to heat
        ii. elastic, insulator to electricity
        iii. dissolves in organic solvents such as benzene or carbon disulphide

20. **Coagulation of latex**

liquid latex + Formic acid (ethanoic acid) → coagulate rubber

a. Rubber is consists of polymer molecules which is surround by a protein membrane which is negative charged.
b. These negative charged repel one another and prevent the rubber molecules from coagulate.
c. When acid (formic acid) is added, positive charged hydrogen ions from the acids neutralize the negative charges on the protein membrane.
d. When the rubber molecules collide one another, the protein membranes break
e. The rubber molecules are released and combined to coagulate



21. When expose to air, bacteria in the air can produce **lactic acid** which coagulates the latex as well
22. **Ammonia or any alkali solution** can be added to latex to **prevent coagulation**

because negatively charged hydroxial ions of ammonia solution can

i. neutralize any positively charged hydrogen ions from acids that presence
ii. prevent the growth of bacteria.

23. **Vulcanisation of rubber**

a. Natural rubber which is soft, easily stretched and cannot withstand heat can be **vulcanised with sulphur** to be more hard, elastic, resistant to heat and stronger.

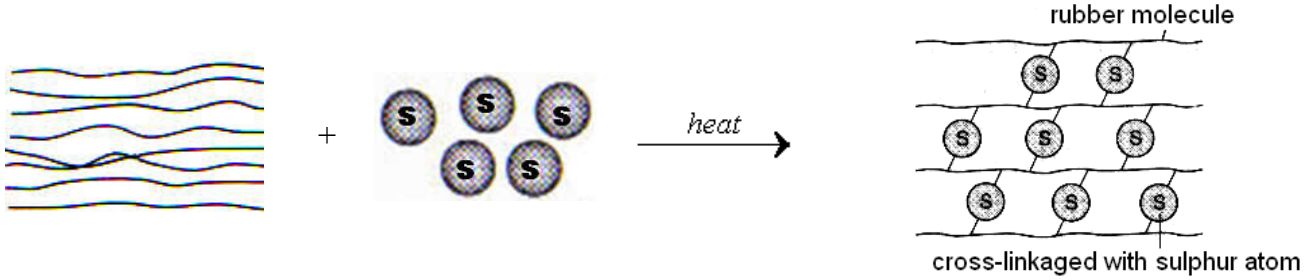
b. Vulcanised rubber is used to make

i. tyres
ii. rubber hose
iii. basket ball
iv. Shoe sole
v. Industrial glove

c.

Natural rubber —(+ acid, Coagulation process)→ **Coagulate rubber** —(+ sulphur, Vulcanization process 2012)→ **Vulcanised rubber**

d. Vulcanisation Process



Natural rubber

- soft
- not heat resistant
- less elastic
- used to make glove and balloon.

Sulphur atoms

Vulcanised rubber

- Sulphur atoms crossed-links between the rubber molecules to prevent it from sliding over one another.
- Become harder, heat resistant and more elastic.
- Used to make tyres, rubber hose or basket ball.

SPEED, VELOCITY AND ACCELERATION

1 a. **Speed** $= \frac{\text{Distance}}{\text{Time}} = ms^{-1}$

b. **Velocity** $= \frac{\text{Distance with direction}}{\text{Time taken}} = ms^{-1}$

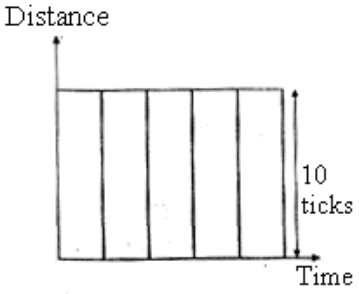
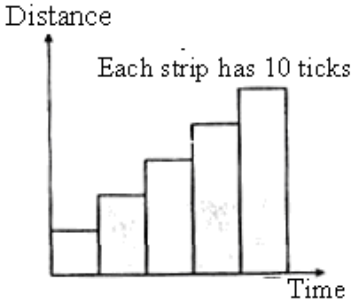
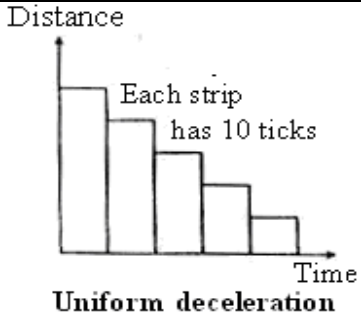
c. **Acceleration**

- is change of velocity per unit time
- **Acceleration** $= \frac{\text{Change of velocity}}{\text{Time taken}} = \frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time taken}}$

$$a = \frac{v - u}{t} = ms^{-1}$$

2. a.

Ticker – Timer

Ticker Tape	Pattern	Interpretation	Graph
 **Direction of motion**	Uniform distance between two consecutive dots	Uniform speed or **uniform velocity**	 **Uniform speed / velocity**
b.  **Direction of motion**	Distance between dots increases uniformly	Speed or velocity increases - increasing velocity	 **Uniform acceleration**
c.  **Direction of motion** **PINANG14**	Distance between dot decreases uniformly	Speed or velocity decreases - decreasing velocity	 **Uniform deceleration** (negative acceleration)

MOMENTUM

Momentum = mass × velocity

Momentum = $m \times v$

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

a. i. **(momentum ↑ = mass ↑ × velocity)**

Mass increase → momentum increase

ii. **(momentum ↑ = mass × velocity ↑)**

Velocity increase → momentum increase

iii. **Hypothesis**

The bigger the mass / velocity, the greater the momentum.

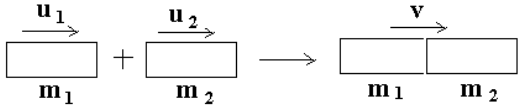
b. **Conservation of momentum**

i. During collision the total momentum of the system remains **unchanged.**

ii. **Total momentum before collision = Total momentum after collision**

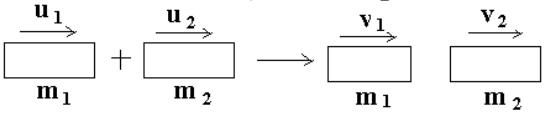
c. **Types of collisions**

i. Inelastic collision (bodies stick together after collision)



$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

ii. Elastic collision (bodies separate after collision)



$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

d. **Applications of Momentum**

i. **Pile driver** (has high momentum due to big mass)

ii. **Bullet fired** from a gun (has high momentum due to high velocity)

iii. **Steam roller** (has high momentum due to big mass)

iv. **Rocket**

- The exhaust gases from the combustion chamber of a rocket escape from the back with great force.
- This creates a great momentum backwards.
- This backward momentum creates an equally big forward momentum, which pushes the rocket forward (This uses the principle that every action creates an equal and opposite direction)

e. **Safety Measures in Motor Vehicles**

i. **Force** = rate of change of momentum

$$= \frac{\text{Change of momentum}}{\text{Time taken}}$$

$$= \frac{\text{Final momentum - Initial momentum}}{\text{Time taken}}$$

$$\textbf{Force } F = \frac{mv - mu}{t}$$

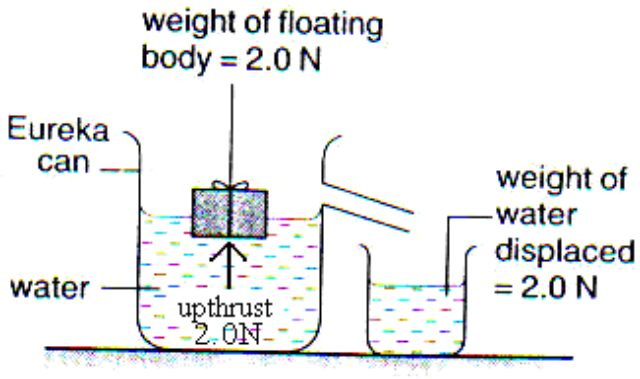
ii. $\mathbf{F} \downarrow = \frac{mv - mu}{t \uparrow}$

Note: **Force is reduced, when time taken is increased**

f. **Parts of the motor car are specially designed to increase the time taken in order to reduce the force.**

i. has front and rear crumple zones to absorb force.
ii. has soft bumper to increase the time of collision
iii. has air bags / safety belt to reduce the impact.

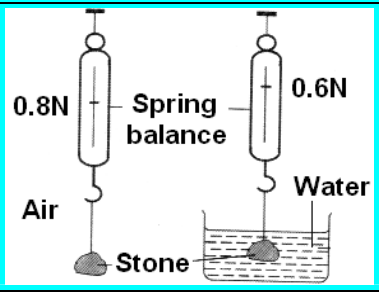
Archimedes' Principle



Upthrust force
= weight of the object
= weight of water displaced
= *mg*
= *pvg*

$\frac{m}{v} = p$

$m = pv$



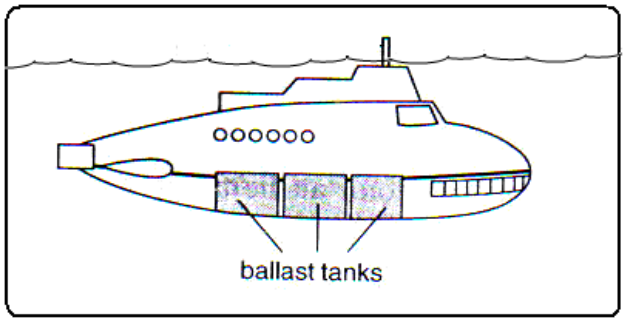
Upthrust **2009**
= weight – weight
on air in water
= 0.8 – 0.6
= 0.2N

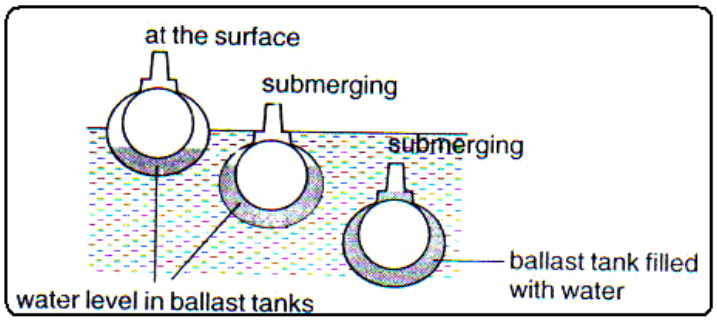
Note: *Denser water such as seawater which contain salt produce bigger upthrust.*
The denser the water, the greater the upthrust / the lighter the object float.

- When an object is immersed in water,
i. the object experience an upthrust
ii. the upthrust is equal to the weight of water being displaced
iii. the object loses some weight

Application of Archimedes' Principle

1. **Plimsoll line**
   - show how much the ship can be safety loaded when sailing in the sea
2. **Submarine**
   - A submarine has ballast tanks. The submarine becomes dense and submerged in the sea when the ballast tanks are filled with the sea water.
   - The submarine becomes less dense and rises to the surface when the ballast tanks are emptied.





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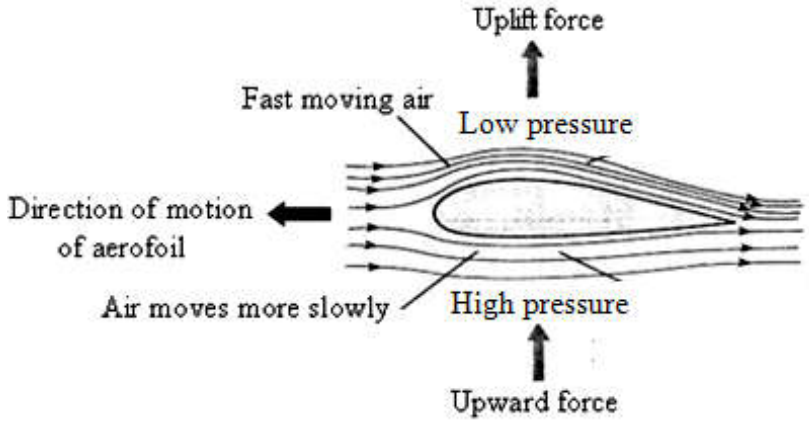
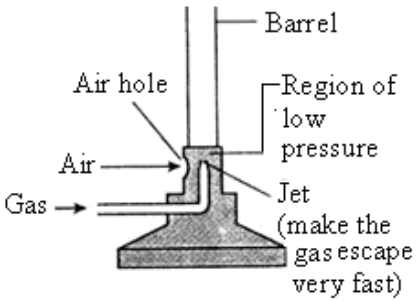
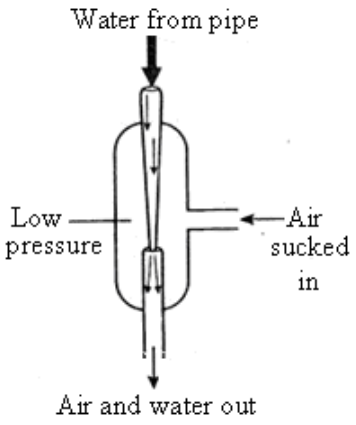
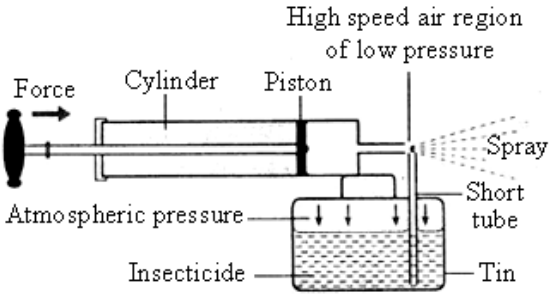
Application of Bernoulli's Principle

1. Aerofoil



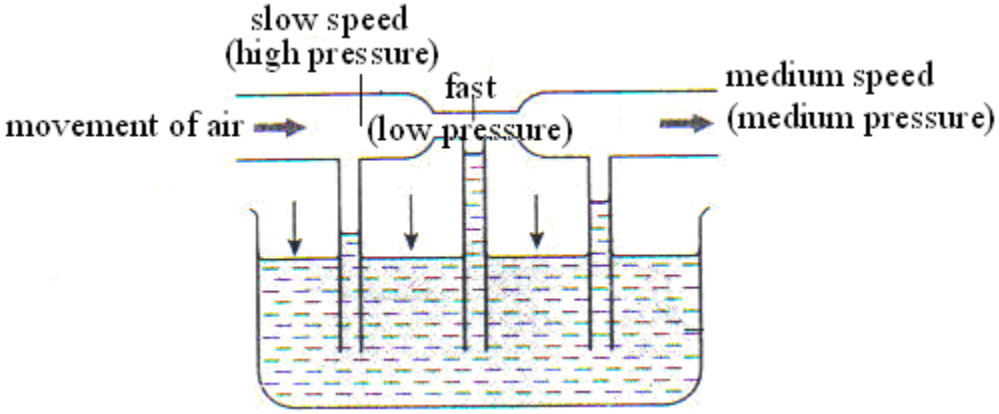
i. The high speed of air moving above the aerofoil produces a low pressure.
ii. The slower speed of air moving below the aerofoil produces higher pressure.
iii. The differences of pressure cause an uplift force on the aerofoil.

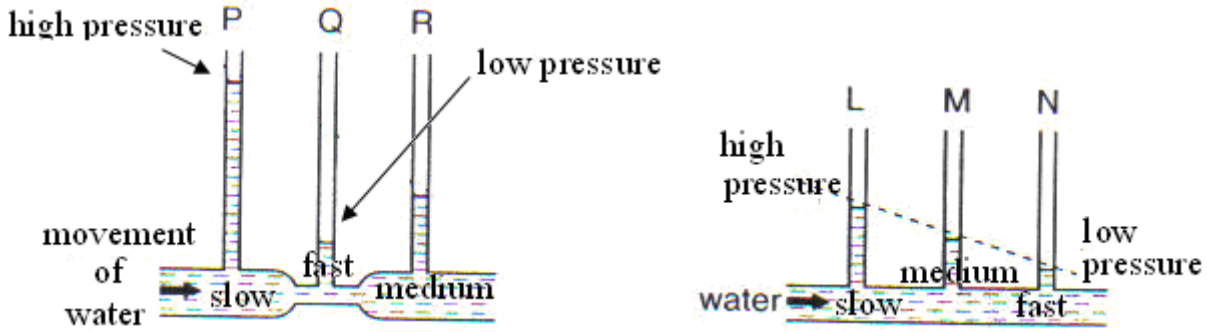
2. **Other apparatus using Bernoulli's Principle**

a. **Bunsen burner**	b. **Filter pump**	c. **Insecticide spray**
		

Bernoulli's Principle

- States that the pressure decreases when the speed of fluid / gas increases.

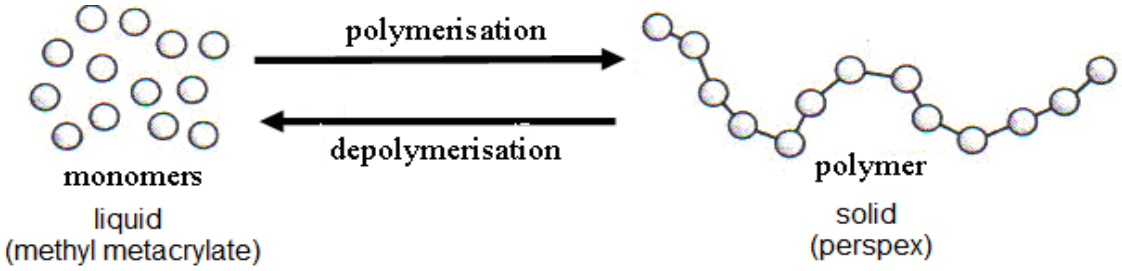




CHAPTER 7 SYNTHETIC MATERIALS IN INDUSTRY

1.a. **Polymer** is along chain of molecules / monomers that are combined together.

b.



c.

Polymer

i. Natural polymer (from plants/animals)
- latex (isoprene),
- cellulose. (glucose)
- starch (glucose)
- protein (amino acid)
- silk
- cotton

ii. Synthetic polymers
made by human from natural gas or fractional distillation of petroleum contain carbon, hydrogen and oxygen elements such as
i. synthetic rubber
ii. synthetic fibres
iii. plastics / perspex

2. **Comparison**

Natural rubber	Synthetic rubber
Similarities	
- Both are carbon compounds - Insulator to electricity - Both exist as polymers	
Differences	
- Very elastic	- Less elastic
- Not so airtight / permeable	- Airtight / non-permeable
- Low heat tolerance	- High heat tolerance
- Good absorber of sound and pressure	- Poor absorber of sounds and pressure
- Easy to vulcanize by sulphur atoms	- Difficult to vulcanize by sulphur atoms
- Easy to oxidise / unstable	- Difficult to oxidise / stable
- eg.: Latex (glove, raincoat)	- eg.: Neoprene, Thiokol, SBR (tyre. Stopper. hoses)

3. **Radio Reception System**

Aerial – to receive modulated carriers waves

a. Tuner
Contain
i. **inductor** to modulate the modulated carrier waves into electric signal.
ii. **capacitor** to pick up modulated carrier waves from selected station and store charges.

→

b.Amplifier
Contain
i. **transistor** to amplify modulated carrier waves.

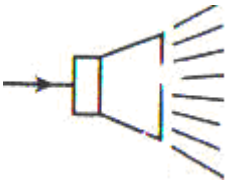
→

c.Detector
Contain
i. **demodulator**
ii. **capacitor**
iii. **Diode** to separate the audio waves from the carrier waves

→

d.Amplifier
Contain
i. **transistor** to amplify the audio waves

e.



Loudspeaker
electric → sound
energy energy

INGAT: Tips diberi berdasarkan Nota bukan soalan kerana bentuk soalan tidak diketahui.