PHYSICS SPM: PAPER 2

Skill 1 – Understanding

Compilation trial states 2020

Smart Revisions

PHYSICS

alinaimanarif

Dream big Aim High Never give up

TRIAL PAHANG & TERENGGANU 2020

Diagram 9.1 and Diagram 9.2 show similar Spring A and Spring B but different thickness undergoes extension when a load of 100 g is suspended at the end of the springs.
Based on the kinetic theory of matter, explain why springs are elastic.

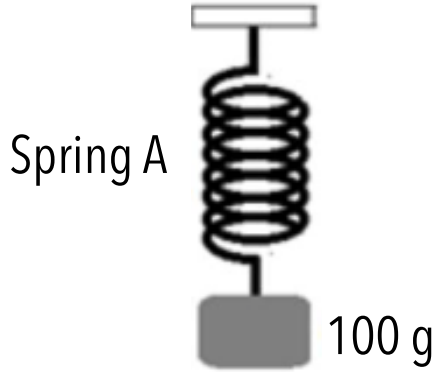


Diagram 9.1

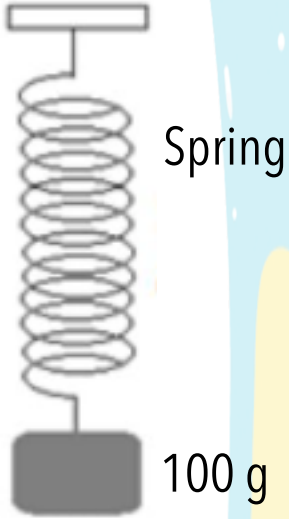
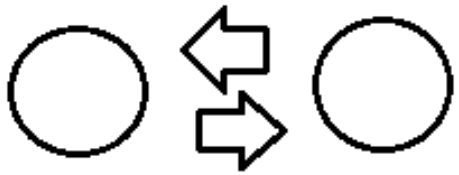
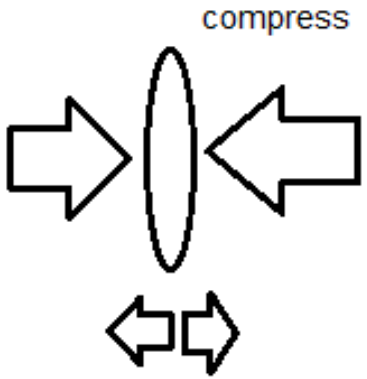


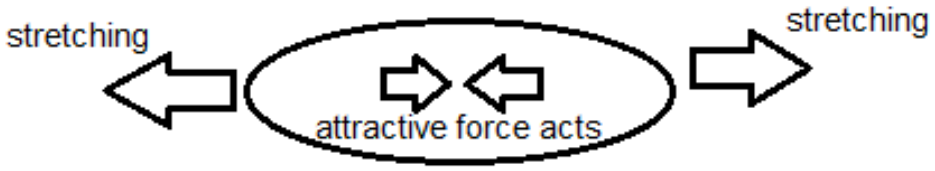
Diagram 9.2



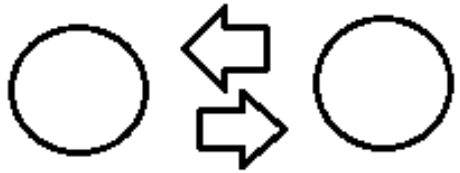
1. Two forces acting between molecules are attractive and repulsive force



3. repulsive force between molecule acts



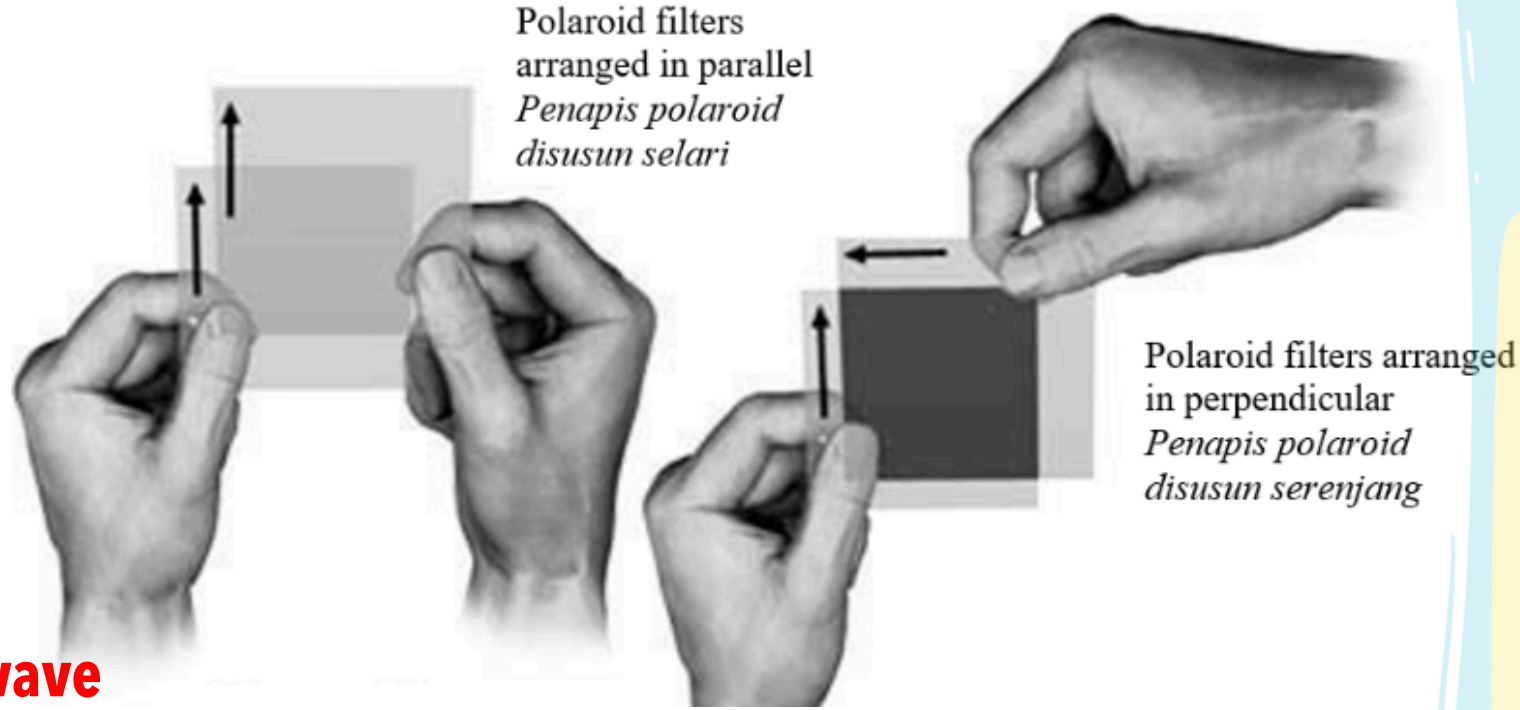
2. When the spring is stretched attractive force between molecule acts



4. When the force is released, the spring returns to its original position due to the forces

TRIAL PAHANG 2020

Polaroid filter activity can prove that a wave is a transverse wave type.
Explain how polaroid filters prove that light waves are transverse waves?



- Light wave is an **electromagnetic wave**
- electromagnetic wave where **electric field** and the **magnetic fie**ld that oscillate **perpendicular** to each other
- When polaroid filters are arranged in a direction **parallel** : **One** component of the field is **allowed through the polaroid filter**.
- When two polaroid filters are arranged **perpendicular**:
  Both field components are **not allowed** through the polaroid filter.

TRIAL PAHANG 2020

Diagram 11.1 shows a submarine in a sea water.
The submarine applies Archimedes' principle to enable it to float and submerged in the sea water.

Explain how the submarine float and submerge in the sea water.

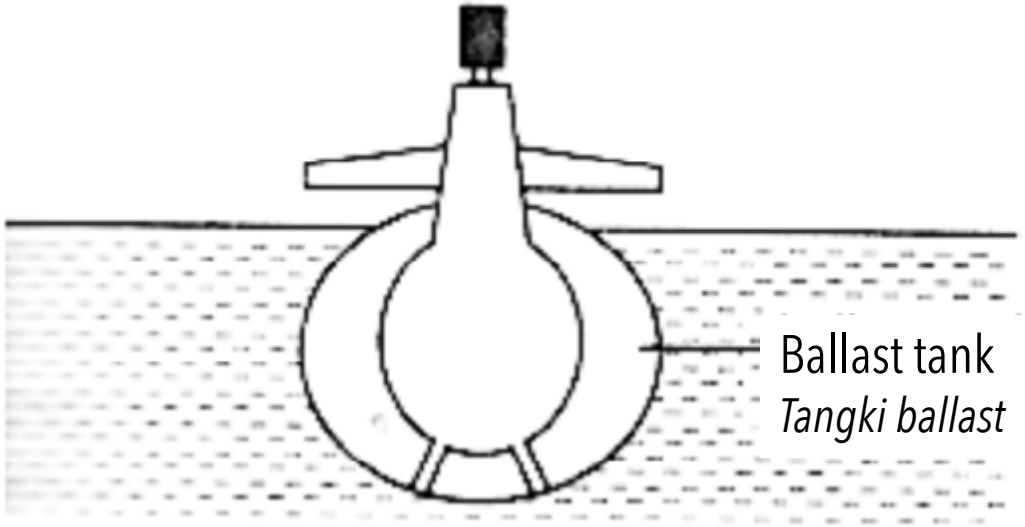


Diagram 11.1

- **Water is driven out** from ballast tank by compressed air
- Weight of submarine **=** buoyant force (submarine **float**)
- **Water is filled** into ballast tank
- Weight of submarine **bigger than** buoyant force (submarine **submerge**)

TRIAL PAHANG 2020

Diagram 12.2 shows the structure of a d.c. electric motor.
Explain how an electric motor is able to rotate.

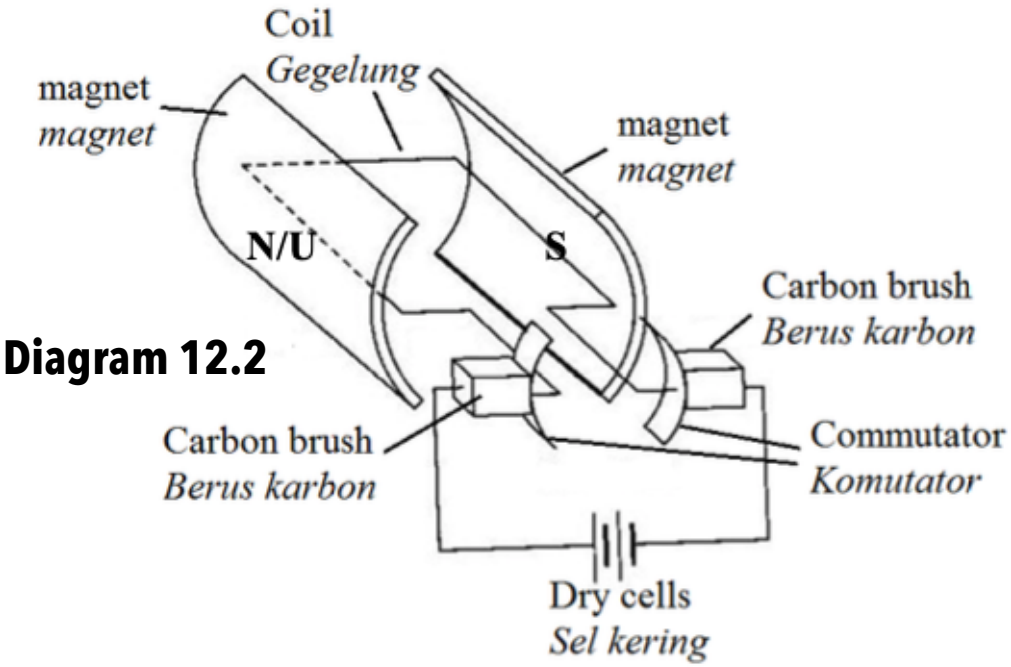
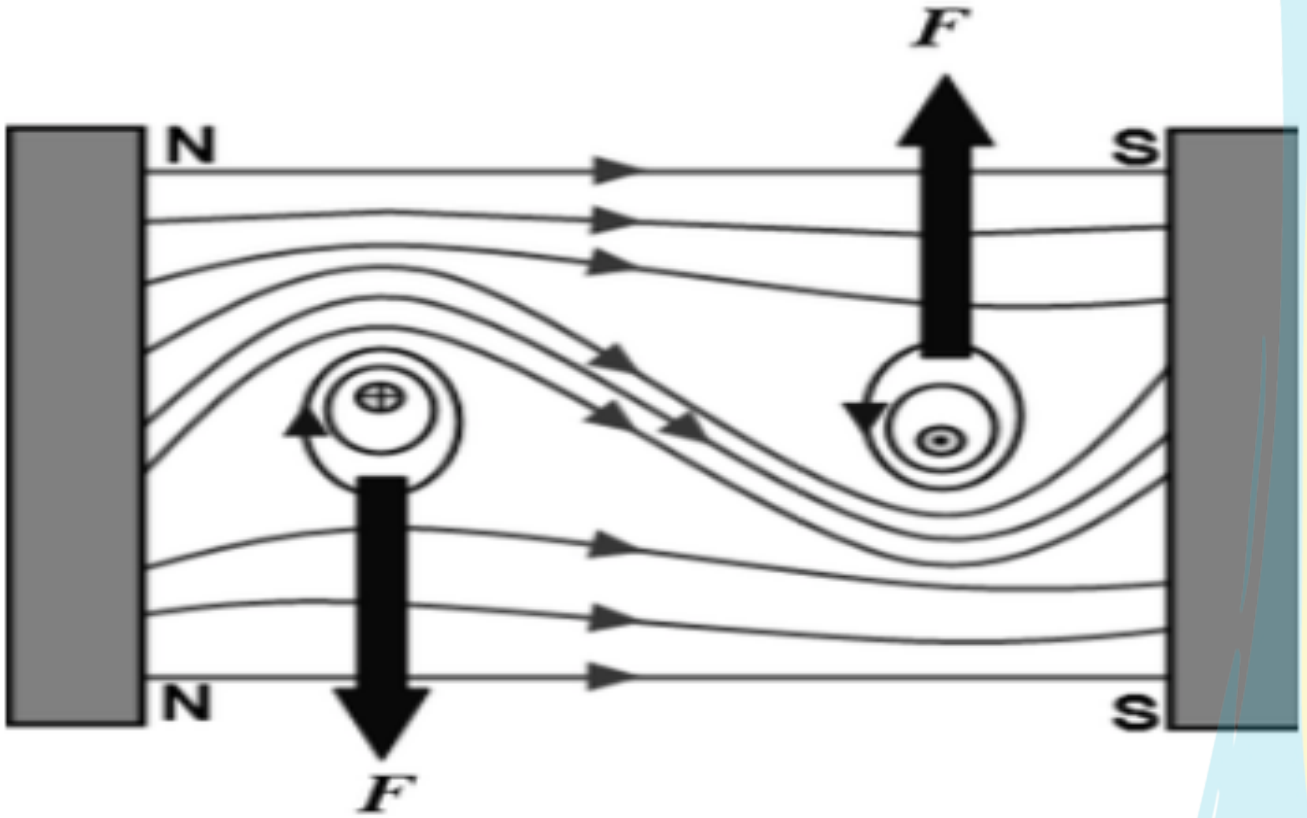


Diagram 12.2



- When **current flow** in the coil, **magnetic field produced**
- **interaction** between two magnetic field
  (permanent magnet & current carrying conductor)
- **catapult field** (pair of forces produced)

While driving a car on a hot day, you may see a mirage on the road as shown on Diagram 9.3. Explain how mirage occurred.

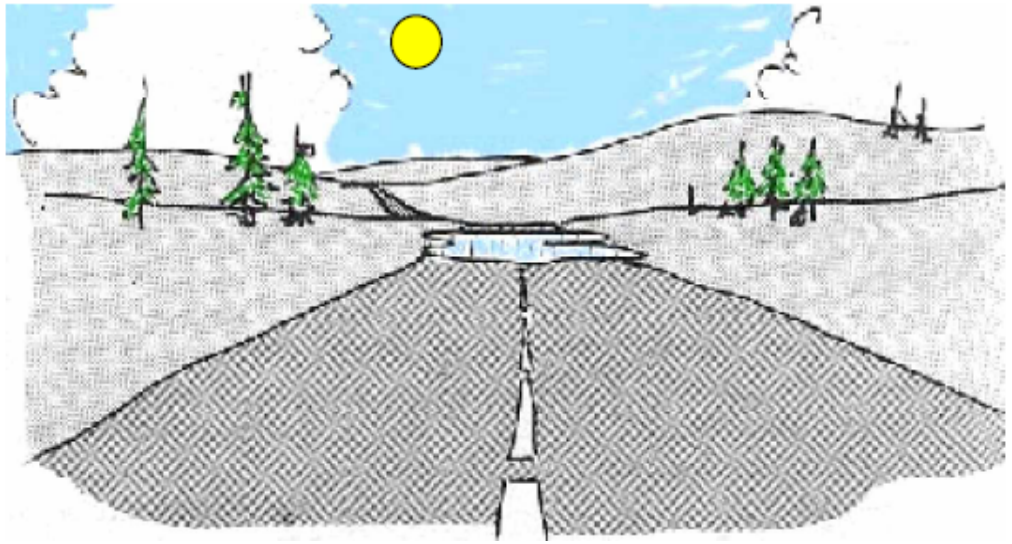


Diagram 9.3

- The layers of air **nearer the road warmer**.
- The **density of air decrease** nearer to the road surface.
- The **light travel from denser to less dense** area.
- The light refract away from the normal
- When the **angle of incidence exceed the critical** angle, **total internal reflection** occurs

Batteries with internal resistance connected in series and in parallel as shown in Diagram 10.3 will affect the brightness of the bulbs. Explain why.

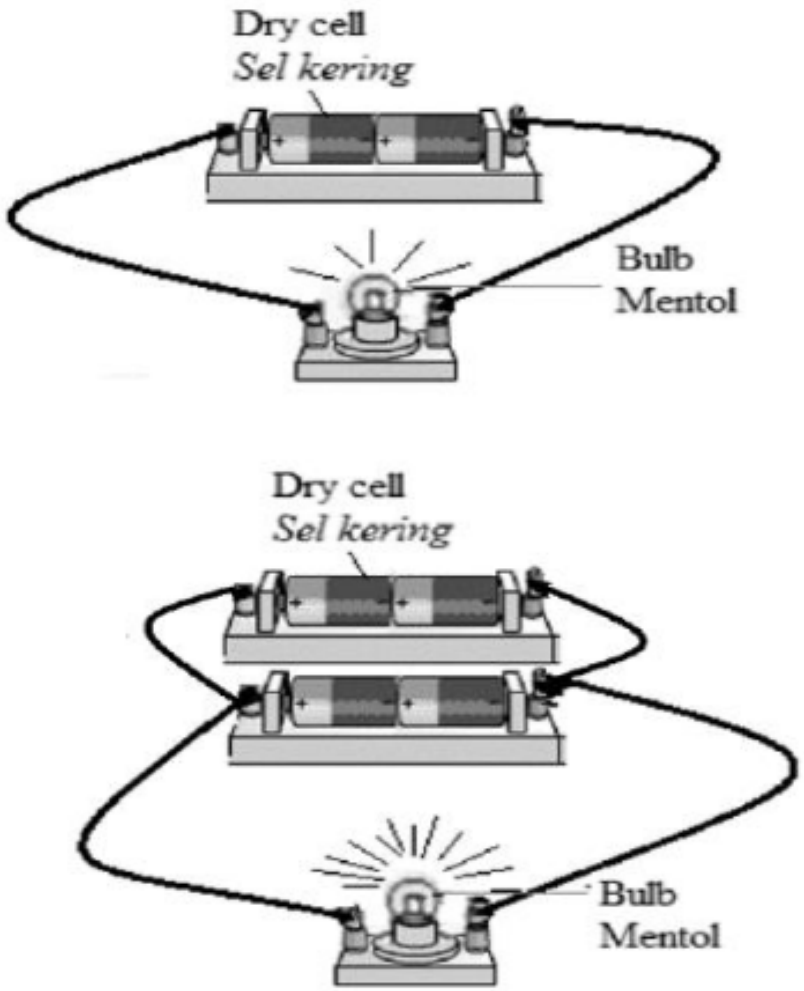


Diagram 10.3

- Bulb is **brighter** using 4 **batteries in parallel**
- 4 batteries in parallel has the **same emf** as 2 batteries in **series**
- Internal resistance for batteries in parallel is less
- Current flow is higher when 4 batteries are connected parallel

Using the concepts of momentum and inertia, explain why the speed and load limit must be imposed on heavy vehicles as depicted in Diagram 11.2.

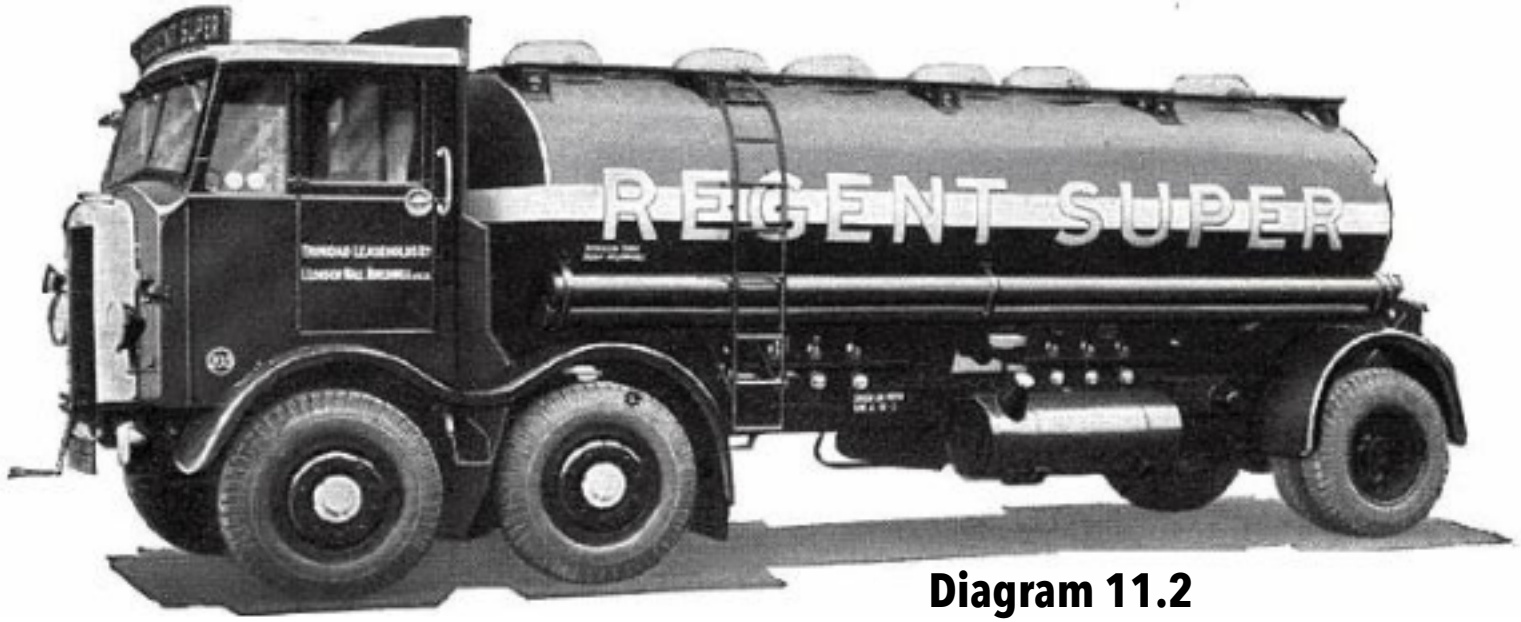


Diagram 11.2

- **Momentum** depends on **velocity** and **mass**
- When the **velocity increases**, **momentum increases**
- **Inertia** depends on **mass**
  When the **mass increases**, **inertia increases**
- It's **difficult to stop** a moving heavy vehicles **carrying big load**

Explain the working principle of the transformer.

- **Alternating current flows** in the **primary coil** induces a magnetic field in the soft iron core
- **The magnetic field** is constantly **changing**
- The **secondary coil** also **experienced magnetic flux linkage** which is constantly changing
- Hence an **alternating e.mf. is induced in the secondary coil**

Diagram 12.1 shows a transformer.

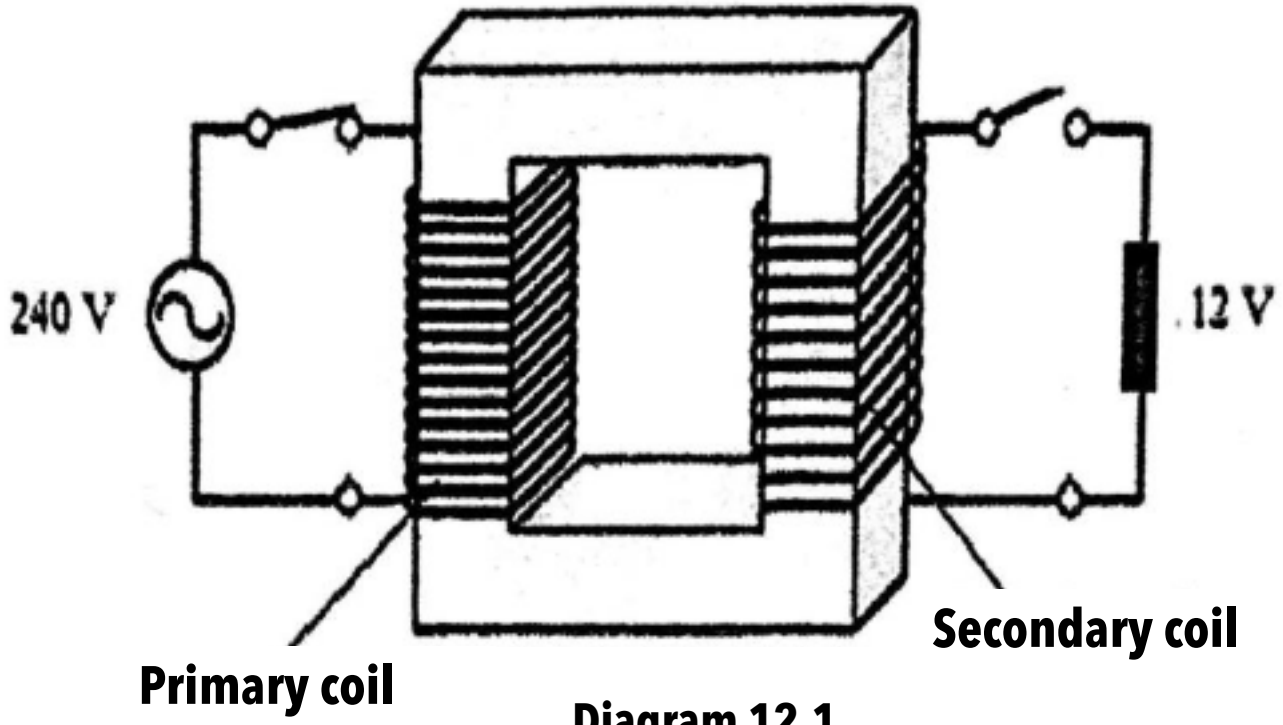


Diagram 12.1

TRIAL TERENGGANU & PUTRAJAYA 2020

Diagram 9.2 shows a hot air balloon.

Diagram 9.2

Name the physics principle involved.

Archimedes' Principle

Explain why the hot air balloon rise up when the air in the balloon is heated.

- **Density of air** in the balloon is **lower**
- **Weight** of **balloon** is **lower** / reduce mass // reduce weight
- **Buoyant Force > weight of balloon**
- **Resultant Force increases** / net force (rises up)

TRIAL TERENGGANU 2020

TRIAL MELAKA 2014

Diagram 10.3 shows an audio frequency generator connected to a speaker and placed near the corner of a wall. Three students, A, B and C, are standing around the next corner.
The generator and speaker can produce sound with the same speed but different pitch.

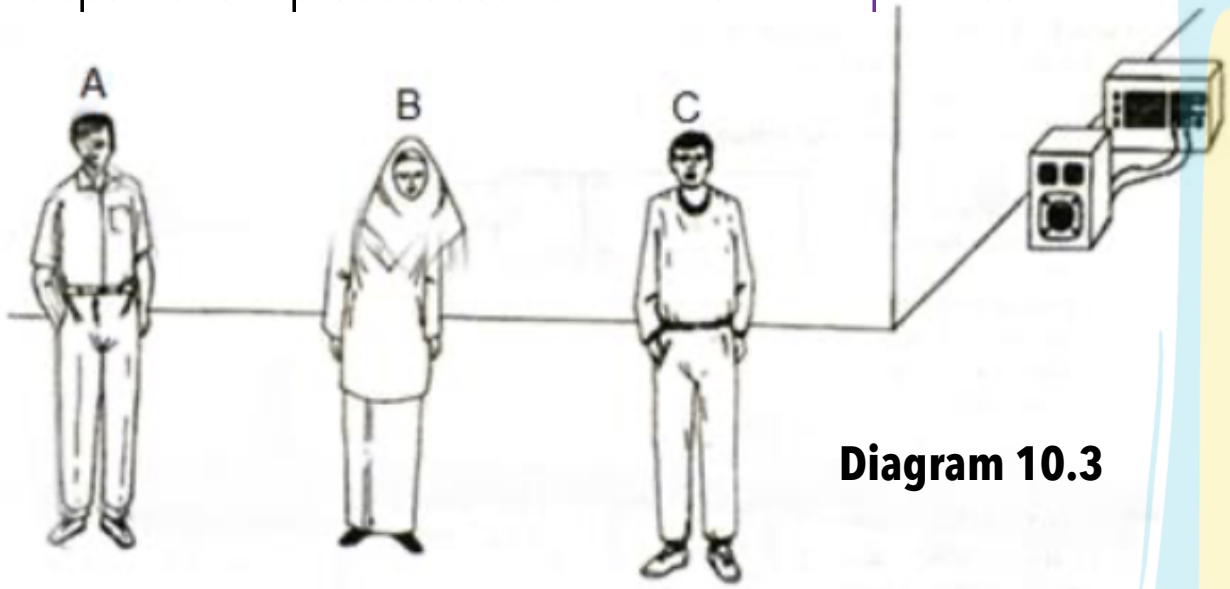


Diagram 10.3

When a high pitch sound is generated, only student C can hear the sound clearly. When a low pitch sound is generated, all the three students can hear the sound clearly. Explain this situation.

- **High pitch** sound has **high frequency** so that the **wavelength** is **shorter**.
- **Less diffraction** of sound wave occur / **sound wave spread less**
- **Low pitch** sound has **low frequency** so that the **wavelength is longer**
- **More diffraction** of sound wave occur / sound wave spread more

TRIAL TERENGGANU 2020

Diagram 12.1 shows how electricity is transmitted from power station to a house using transmission cables and transformers.

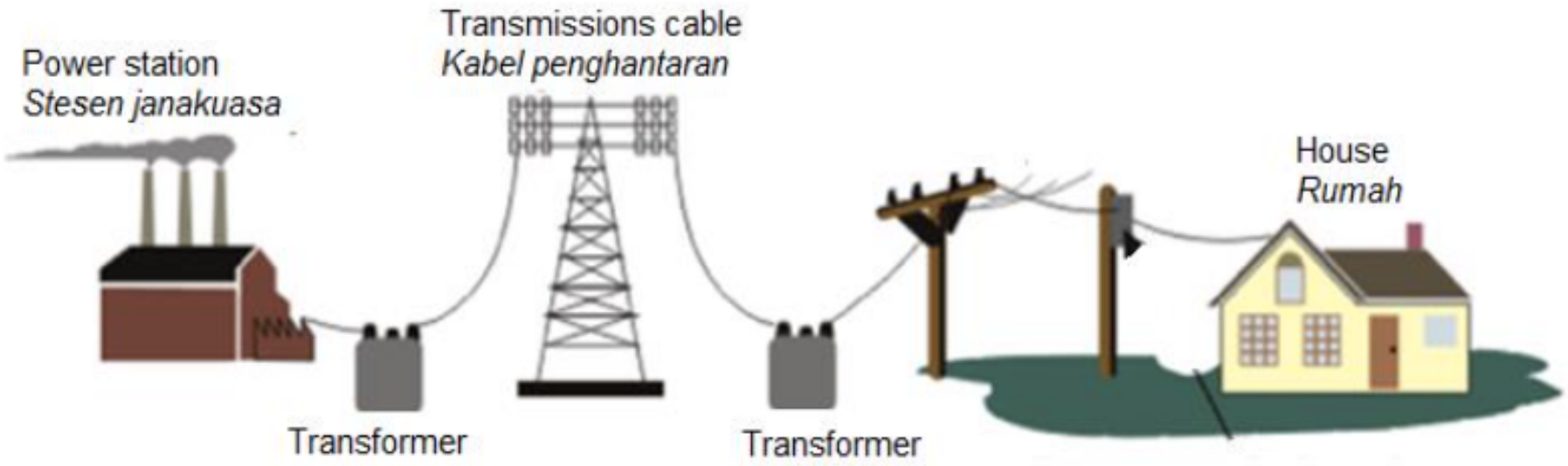


Diagram 12.1

Function of the transformer: To Increase or decrease the output voltage

Power loss in the transmission cables occurs during the transmission of the electricity to the house. Explain how to reduce the power loss in the transmission cables .

- Use **thick** cable / copper / aluminum
- To **reduce resistance**
- **Increase the voltage**
- **Reduce current**

Diagram 9.3 shows a balloon on a bed of nails which does not pop when a load is put on it.

Explain why the observation is happened.

- **Force** / load is applied on the surface area of **bed nails**
- Bed of nails provided **more surface area** per unit
- **Force spread** to more surface area per unit
- resulted **smaller pressure** applied

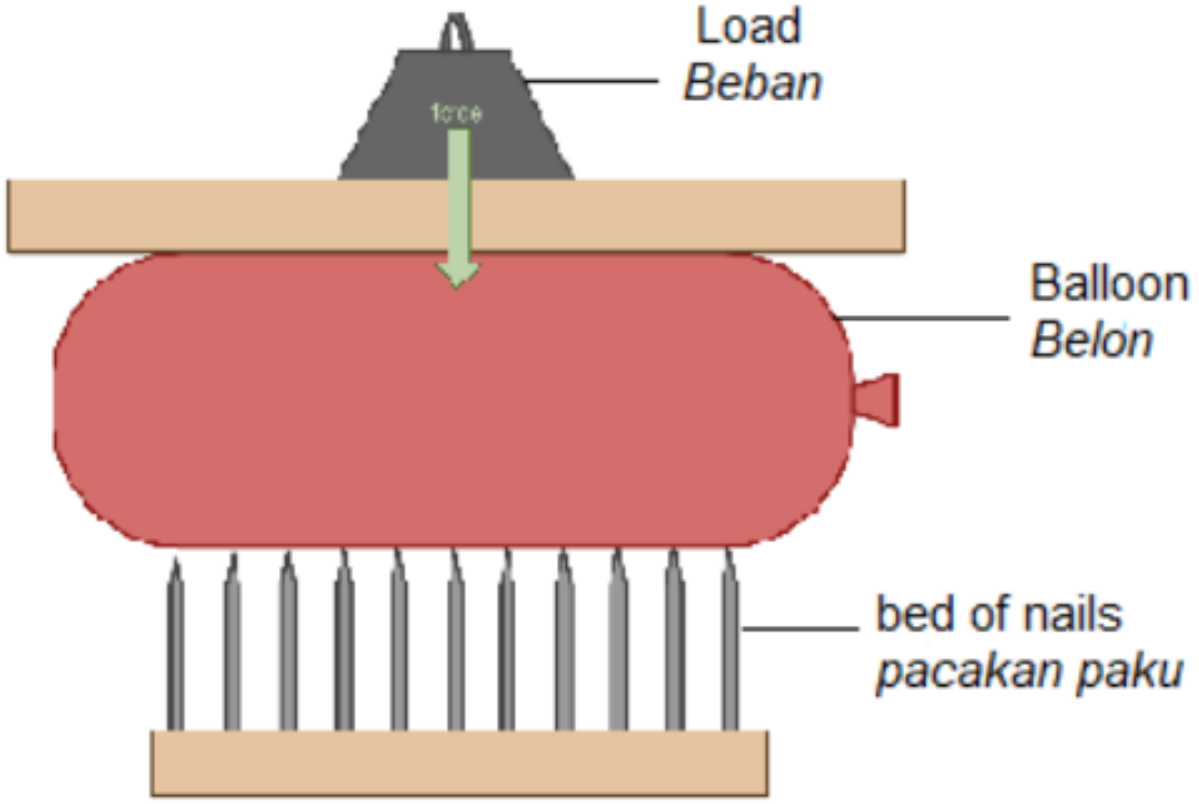


Diagram 9.3

Diagram 11.2 shows what happen when a dented ping pong ball is poured with boiled water.

Charles' law

By using kinetic theory of gas, explain the changes in volume, pressure and temperature of the ping pong ball after boiled water is poured onto it.

- **Temperature** of the air / gas will **increase**
- **Kinetic energy** will **increase**
- **Average speed** of gas molecules **increases**
- **Distance between gas molecules increase**
- When the pressure is fixed, volume of gas increases then the **ball expands**

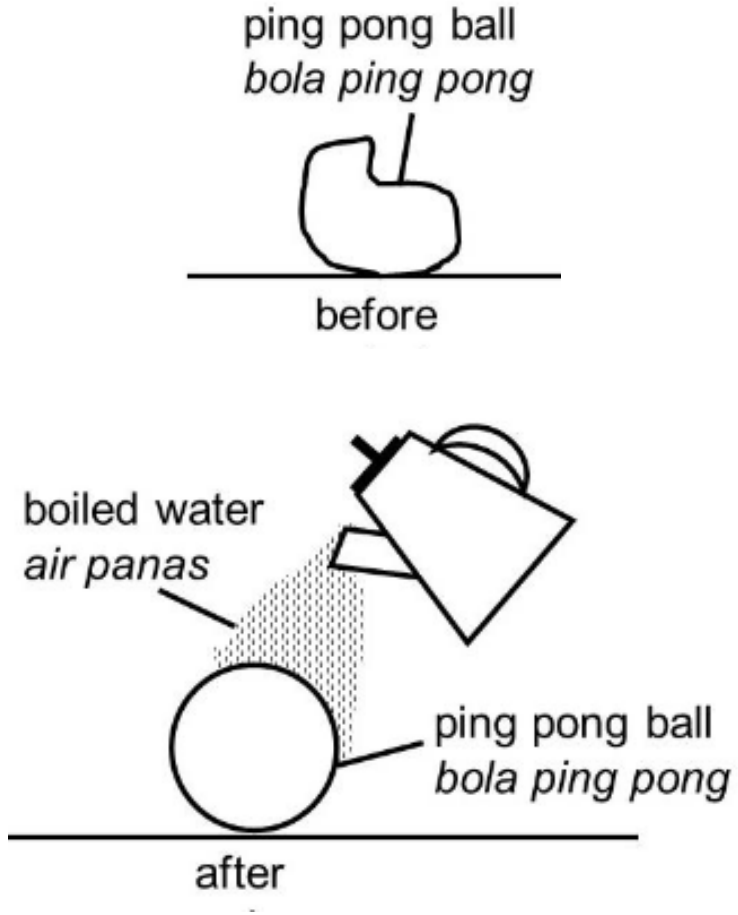


Diagram 11.2

TRIAL MRSM 2016

Diagram 12.1 shows a circuit which is used determine the internal resistance, of a dry cell.

Based on Diagram 12.1, sketch the expected voltage against current graph and explain how the electromotive force, E, and internal resistance, r, of a dry cell can be determined.

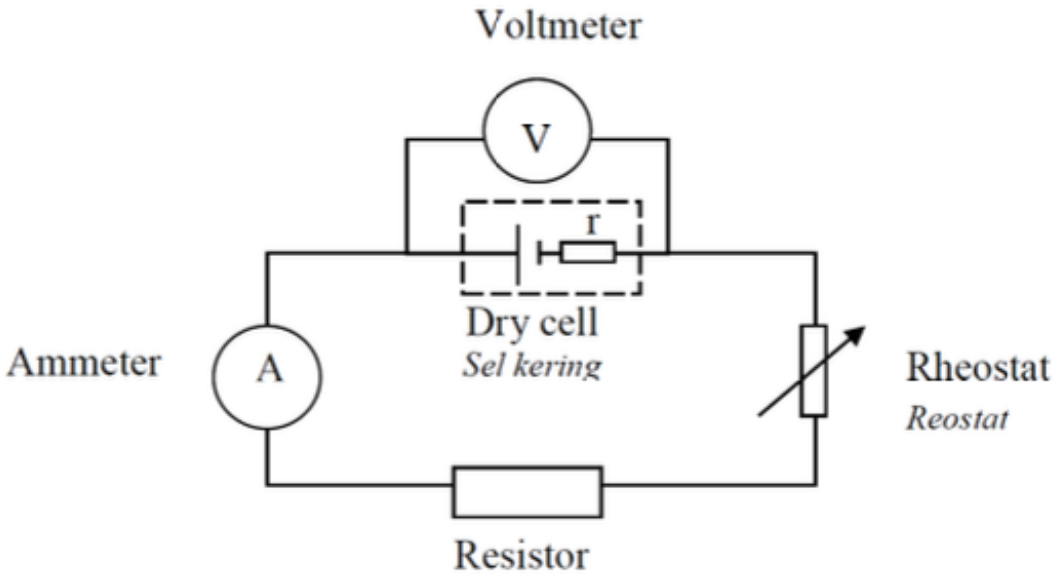
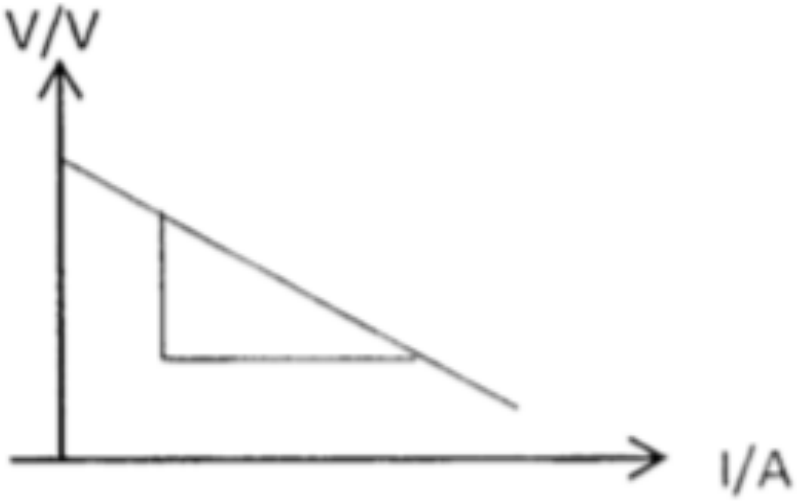


Diagram 12.1

internal resistance :
the resistance against the moving charge due to electrolyte in dry cell



- when I = 0 A
- Electromotive force, E = intercept at V- axis
- Gradient of the graph is (-ve) internal resistance

TRIAL KELANTAN 2020

Diagram 9.2 shows a force, F against extension, x graph of two different springs of same length, P and Q.

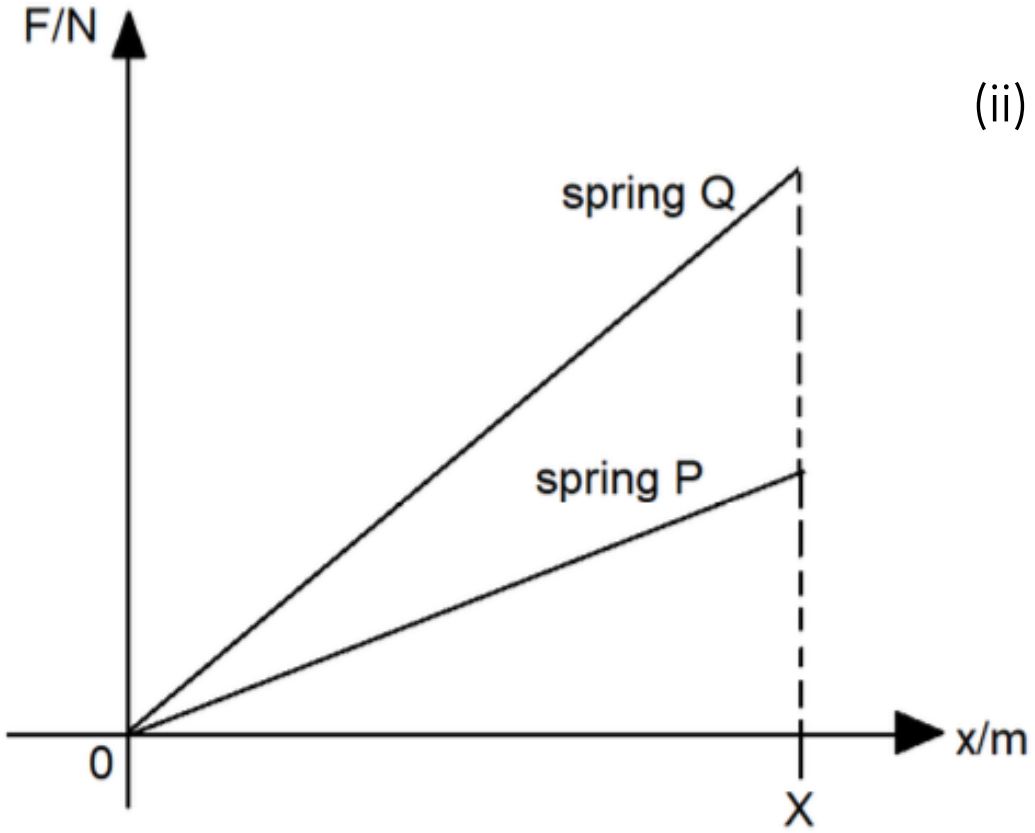


Diagram 9.2

(i) determine which spring that has a bigger elastic potential energy and spring constant.

spring **Q**

(ii) Explain your answer and state the relationship between elastic potential energy and spring constant.

- Spring constant = gradient of the graph
- Q higher gradient
- Elastic potential energy = area under the graph
- Spring constant increase, Elastic potential energy increase

TRIAL KELANTAN & MELAKA 2020

Based on the characteristics of alpha particles, explain why an isotope that emits alpha particles is not suitable to be used as a tracer in medicine.

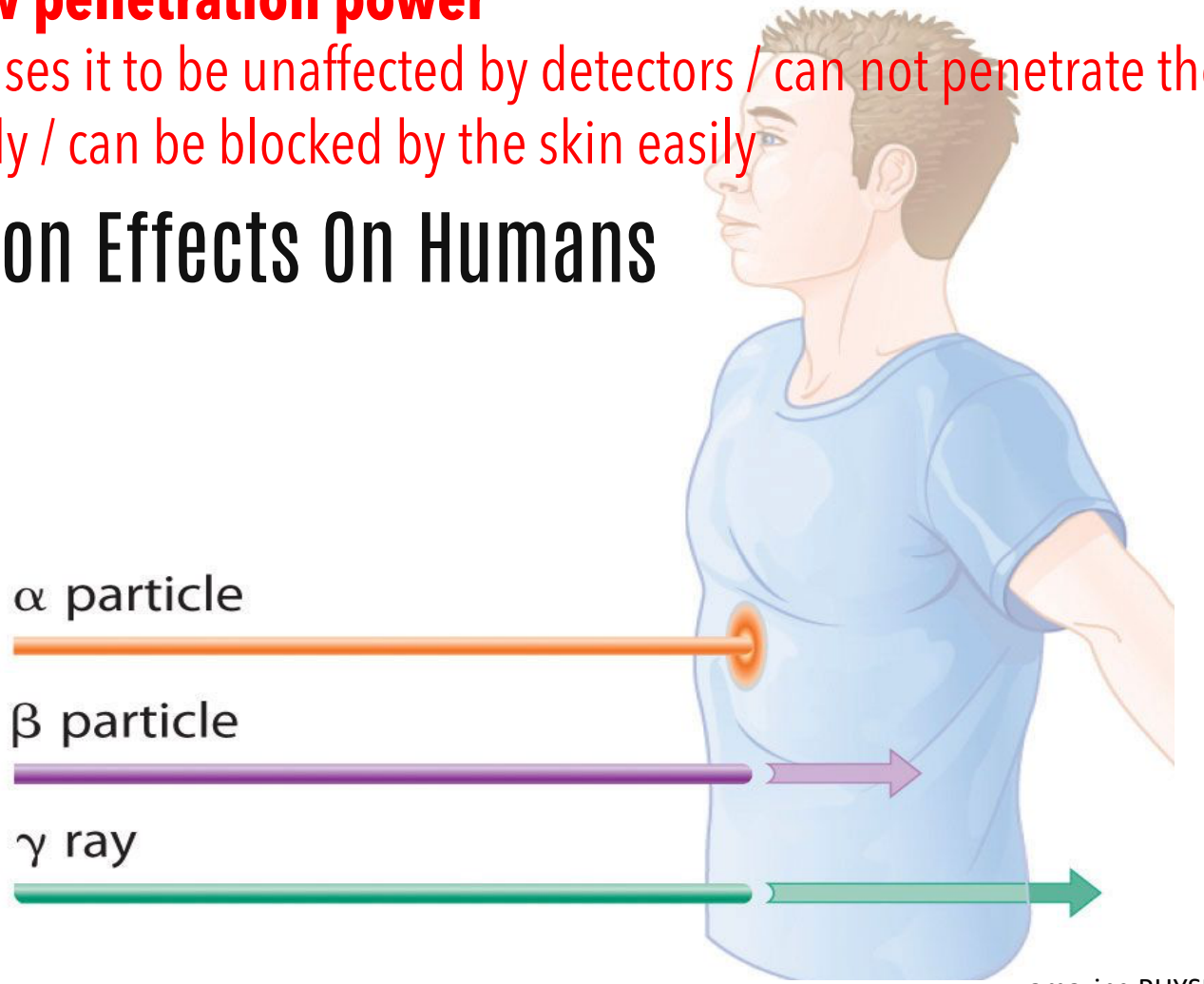
- **High ionization power**
- because it will damage the cell / dangerous / damaging cells / mutations
- **Low penetration power**
- Causes it to be unaffected by detectors / can not penetrate the human body / can be blocked by the skin easily

Radiation Effects On Humans

Low

Intermediate

High



TRIAL KELANTAN 2020

Diagram 11.1 shows water spurting out from a container at different depth and pressure.

Explain why the horizontal distance of water spurting, d, from the position P and Q as shown in Diagram 11.1.

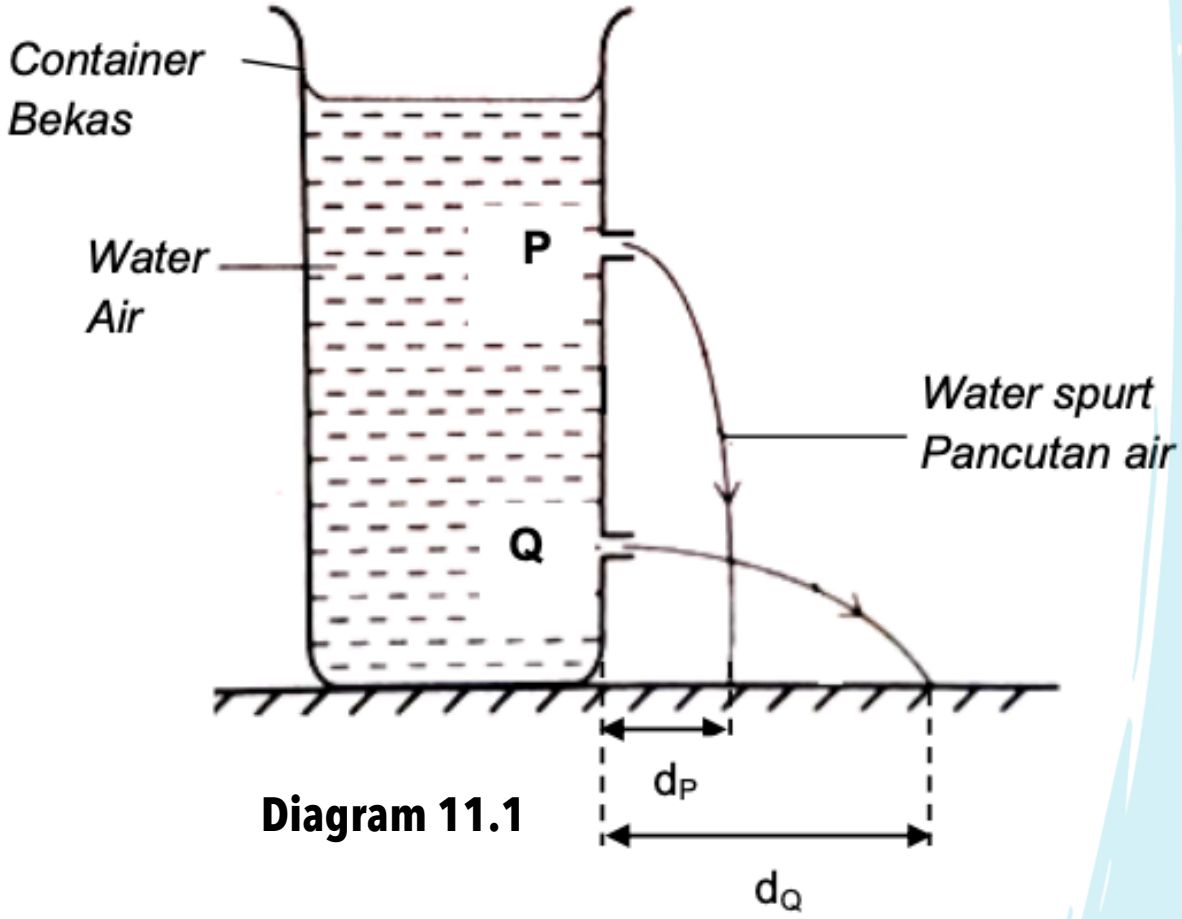


Diagram 11.1

- The **depth** of water at position **Q** is **deeper** ($d_Q > d_P$)
- The water **pressure** at position **Q** is **greater** ($P_Q > P_P$)
- Depth increase, pressure increase
- Water **velocity** at position **Q** is **higher**
- The distance of water spurting at position Q is further

TRIAL KELANTAN 2020

Diagram 12.1 shows a radar transmitting a microwave signal at an airport. A microwave is a type of transverse waves which emitted to determine the position of an aeroplane.

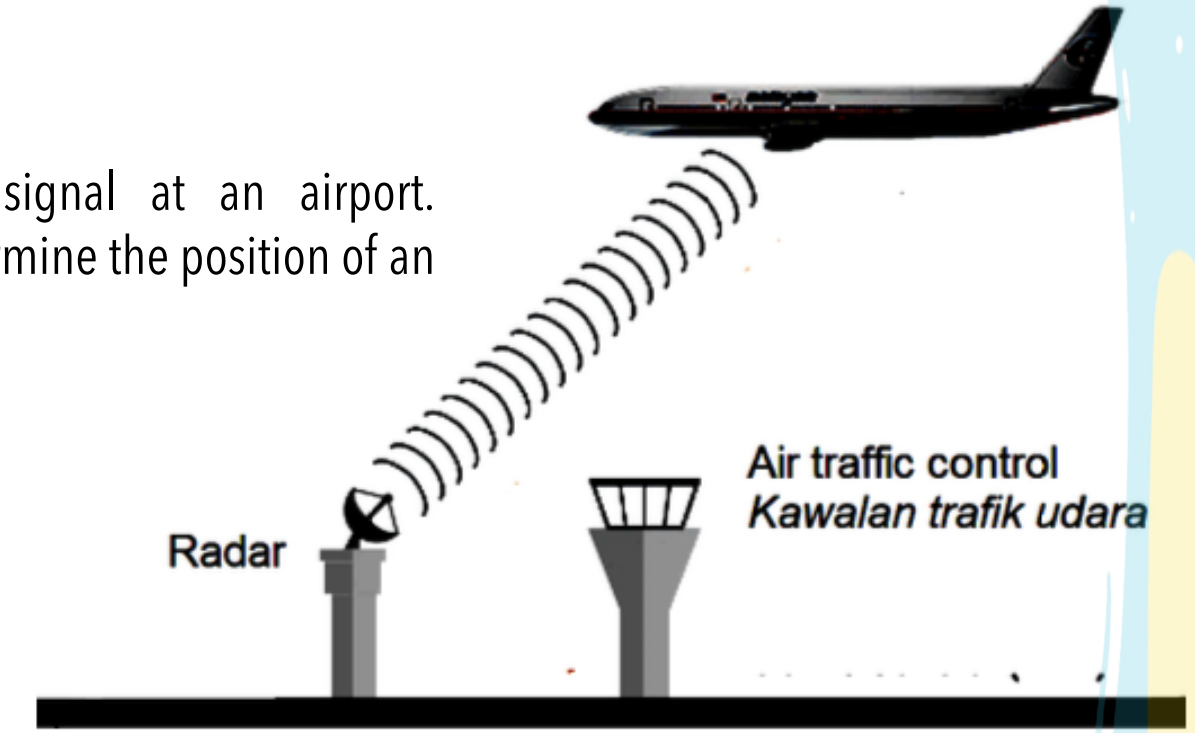


Diagram 12.1

Explain how the position of the aeroplane can be determined.

- Radar send signal to the aeroplane
- The signal reflected from the aeroplane
- Receiver on the radar capture signal.
- Data displayed the position of the aeroplane is calculated by using formula:

$$s = \frac{vt}{2}$$

Diagram 9.3 shows how a fish can be cooked by using a steamer.
Explain the process.

- **Steam cannot goes out** because of the **steamer** is **closed**
- The **steam condensed** on the fish
- The **fish absorbs specific latent heat of fusion** from the condensed steam
- **Water has high specific latent heat**
- Fish can be **cook faster**

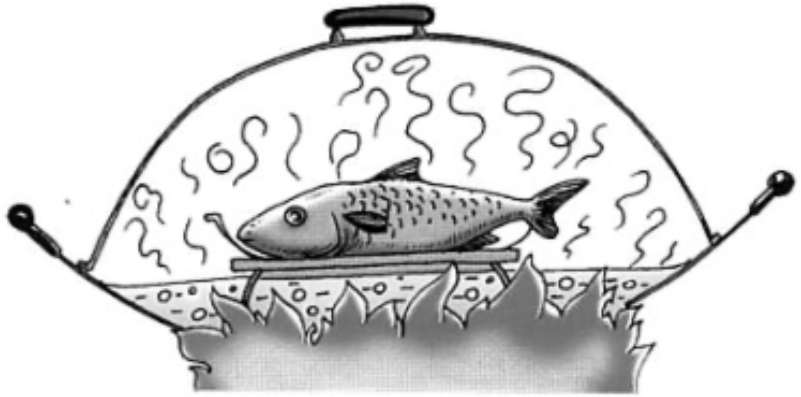


Diagram 9.3

Steaming food

Food such as cakes, eggs, fish, buns and others receive a large amount of energy when the latent heat of vaporization of steam released from condensing steam

Diagram 11.1 shows a helmet, gloves and jacket worn by bikers of a motorcycle racing tournament. Diagram 11.2 shows the scenery when there is a crash that could happen in a race.

Explain why the bikers must wear the helmet, gloves and jacket in a race.

- To increase the time of impact
- To reduce impulsive force
- Helmet – to protect the head
- Jacket – to protect the body

Diagram 11.1

Diagram 11.2

Diagram 12.1 shows a Barton's pendulum which consist of six pendulums tied to a horizontal string. When X is displaced and released, it will oscillate with its natural frequency.

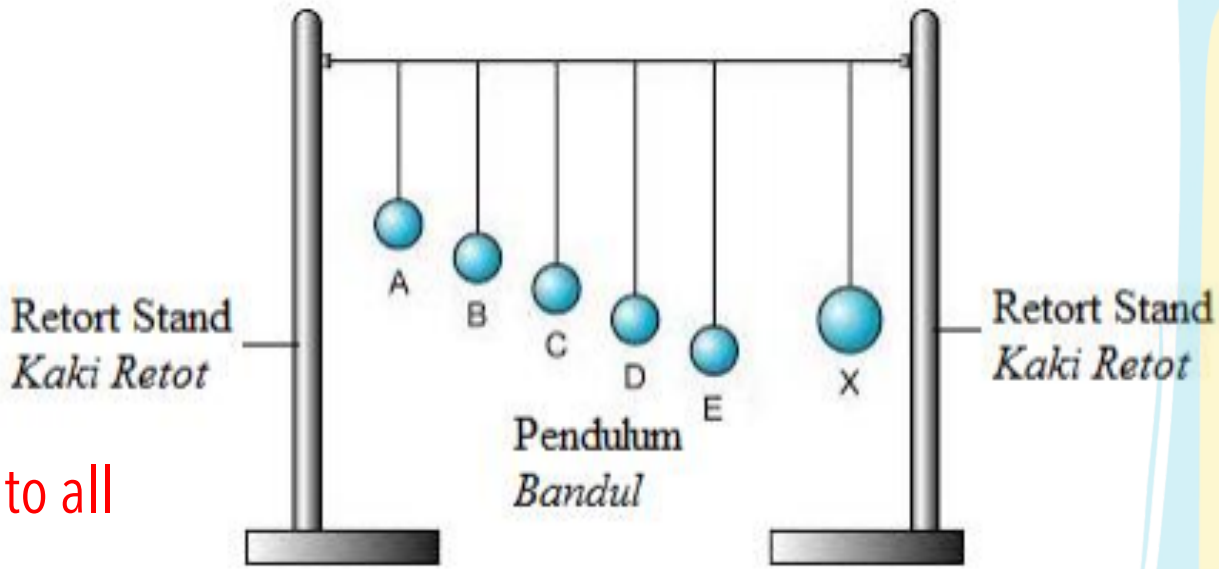


Diagram 12.1

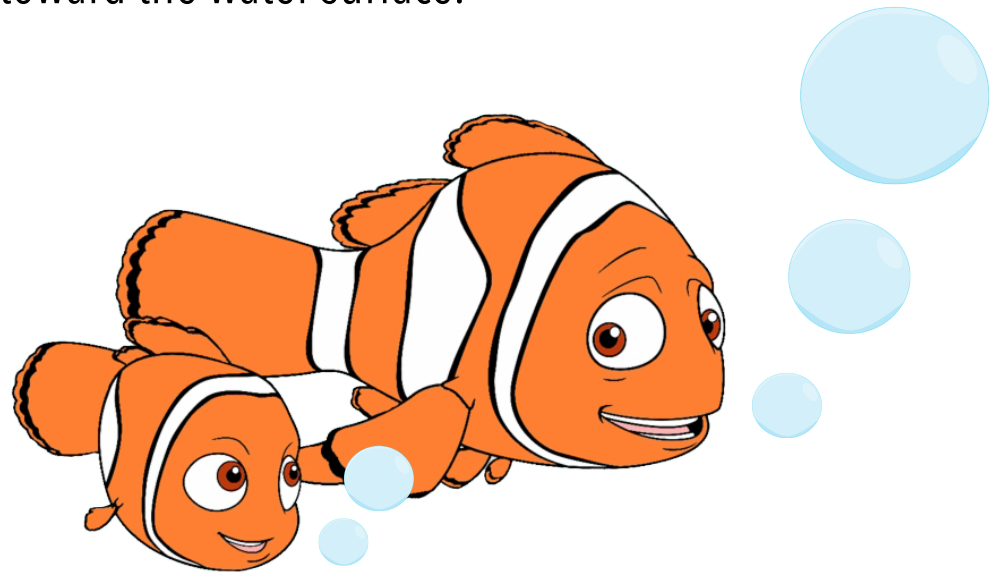
Explain how the phenomenon of resonance occur in Diagram 12.1.

Frequency of any oscillating system in the absence of any other forces.

- Force oscillation at X
- Wave transfer energy equally through the string to all pendulum
- Pendulum B will oscillate with maximum amplitude
- Because the natural frequency of B is the same as natural frequency of X // length pendulum X is equal to the length of pendulum B
- Resonance occurred

TRIAL PULAU PINANG 2020

Explain why the size of an air bubble released by a fish at the bottom of a lake increases when it moves toward the water surface.



- Depth **increase**, pressure **increase**
- Air bubble **rise up**, **depth** is **decrease**
- When the **air pressure decreases**, **volume** will **increases**
- Volume increases thus **size increases**.

Boyle's law

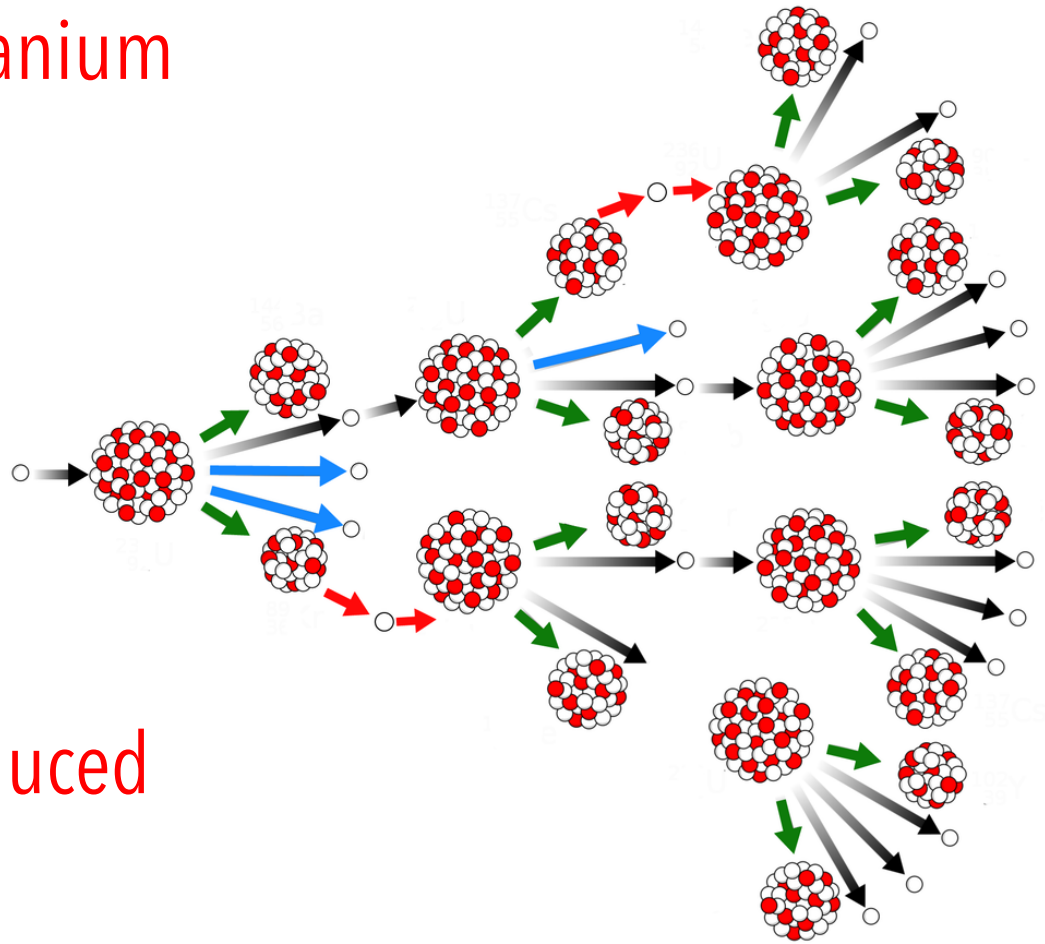
$$P \propto \frac{1}{V}$$

$$P_1V_1 = P_2V_2$$

NUCLEAR ENERGY

Nuclear fission produces a chain reaction. Describe how the chain reaction happens in a nuclear fission of an atom of uranium.

- Neutron bombard a uranium nucleus
- Three neutrons are produced
- These new neutrons bombard new uranium nucleus (exceed critical mass)
- For every reaction the neutrons produced will generate a chain reaction



Bernoulli's principle

Diagram 11.1 shows a lady and a boy are standing behind the yellow line at a railway station when a train is moving fast entering the station.

What will happen to the lady and the boy if they are standing in front of the yellow line when the train is moving fast entering the station? Explain your answer.

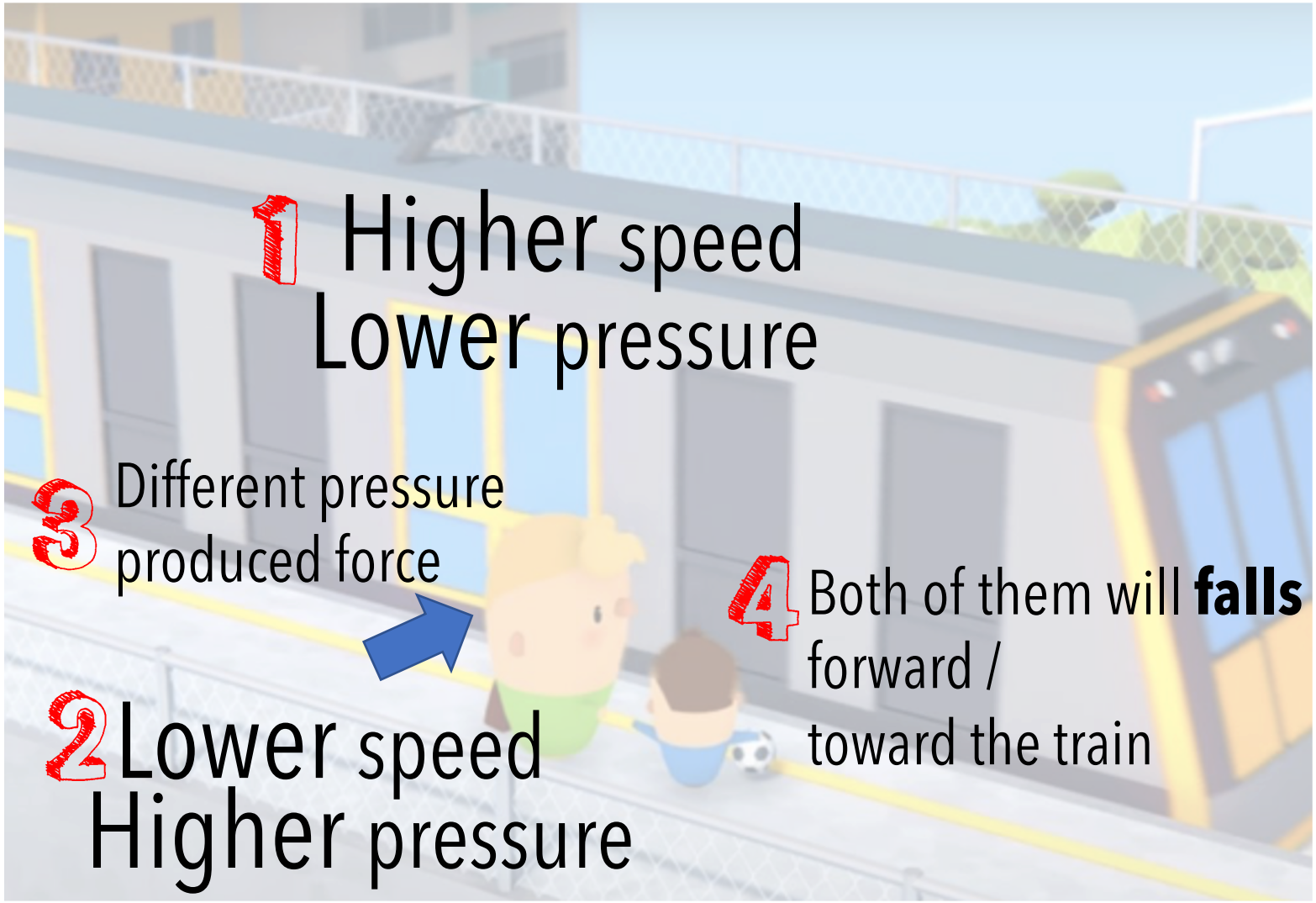


Diagram 11.1

CHAPTER 3: FORCES & PRESSURE

A vessel which has 2 holes, X and Y at difference height as shown on Diagram 1.
When the vessel is filled with water, water spurts out from the two holes due to the water pressure.

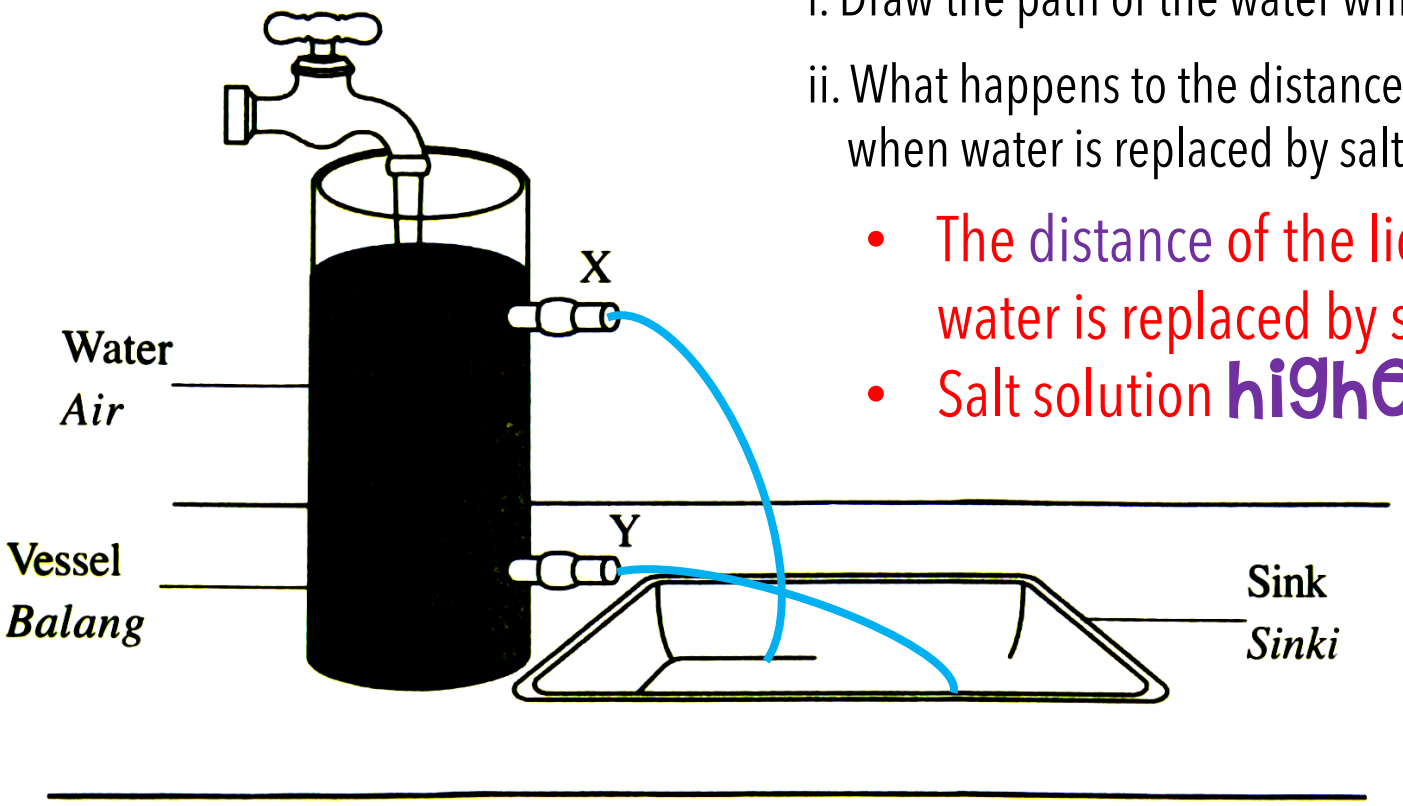


Diagram 1

i. Draw the path of the water which spurts out from the holes X and Y.

ii. What happens to the distance of the liquid spurting out a hole X when water is replaced by salt solution? Explain your answer.

- The distance of the liquid spurting out a hole X when water is replaced by salt solution **increase**.
- Salt solution **higher density** compared to water
- Density **increase**, pressure **increase**

SKILL 1 - UNDERSTANDING

CHAPTER 3: FORCES & PRESSURE

A hydraulic jack which is used to lift up a car as shown on Diagram 2.
The working principle of the hydraulic jack is based on the Pascal's principle.
Explain how the hydraulic jack can be used to lift a car when force F_1 is applied on the small piston with cross-section area A_1. In your explanation, state the reason why force F_2 is greater than force F_1.

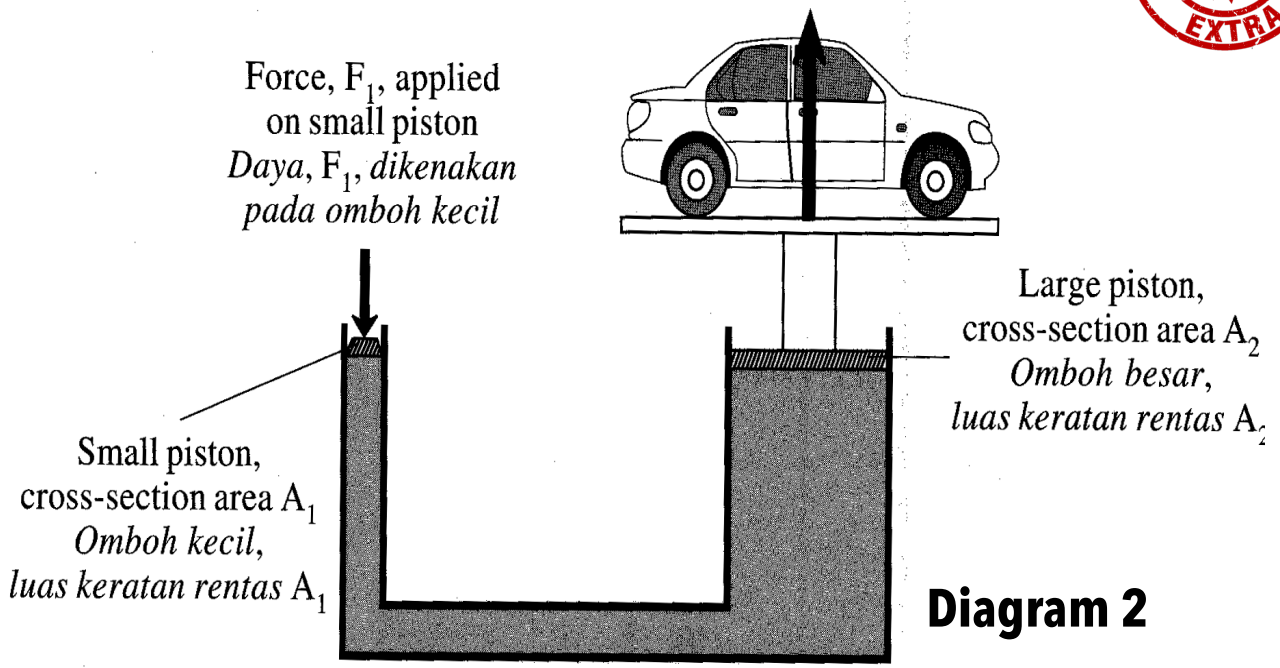


Diagram 2

- Small force exerted on piston A_1 produce **pressure**.
- The **pressure** is **transmitted equally** throughout the system.
- The pressure exerted on big piston (A_2) produce **output force** (F_2)
- Since the **surface area piston A_2** > **piston A_1**, therefore **output force** produced for big piston is **greater**.

CHAPTER 3: FORCES & PRESSURE

Diagram 3 shows the cross-section of a wing of a moving aeroplane. A lifting force is exerted on to the wing.

Name the shape of the cross section shown in Diagram 3.

Explain how the lifting force is produced.

Aerofoil.

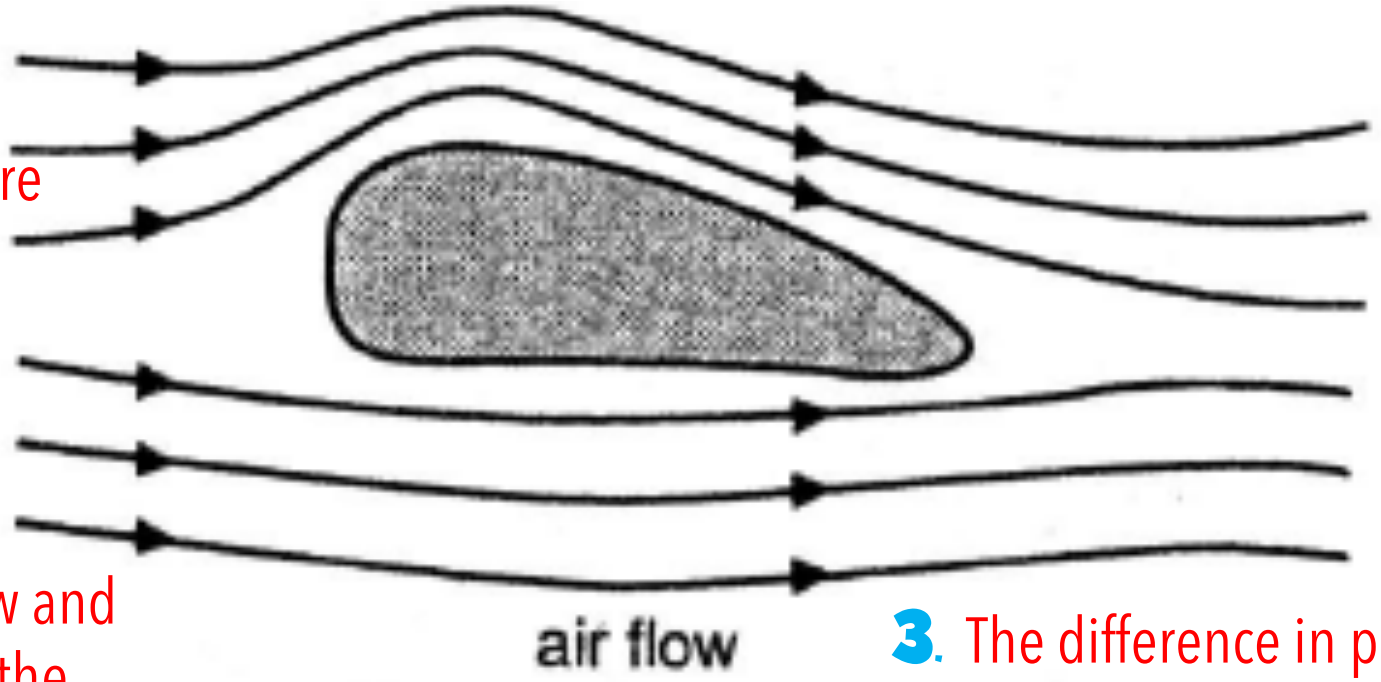


Diagram 3

1. The velocity of air is high and the air pressure is low at the top of the aerofoil.

2. The velocity of air is low and the air pressure is high at the bottom of the aerofoil.

3. The difference in pressure produces a lifting force.

CHAPTER 3: FORCES & PRESSURE

Diagram 4 shows what happens when a wooden block is held above the water surface and then released into the water.
When the wooden block is released, it falls into the water and goes completely under the water surface.
Then it moves upwards and floats on the water surface.
Using the concept of buoyant force, explain why the **wooden block moves upwards** and then **floats** on the water surface.

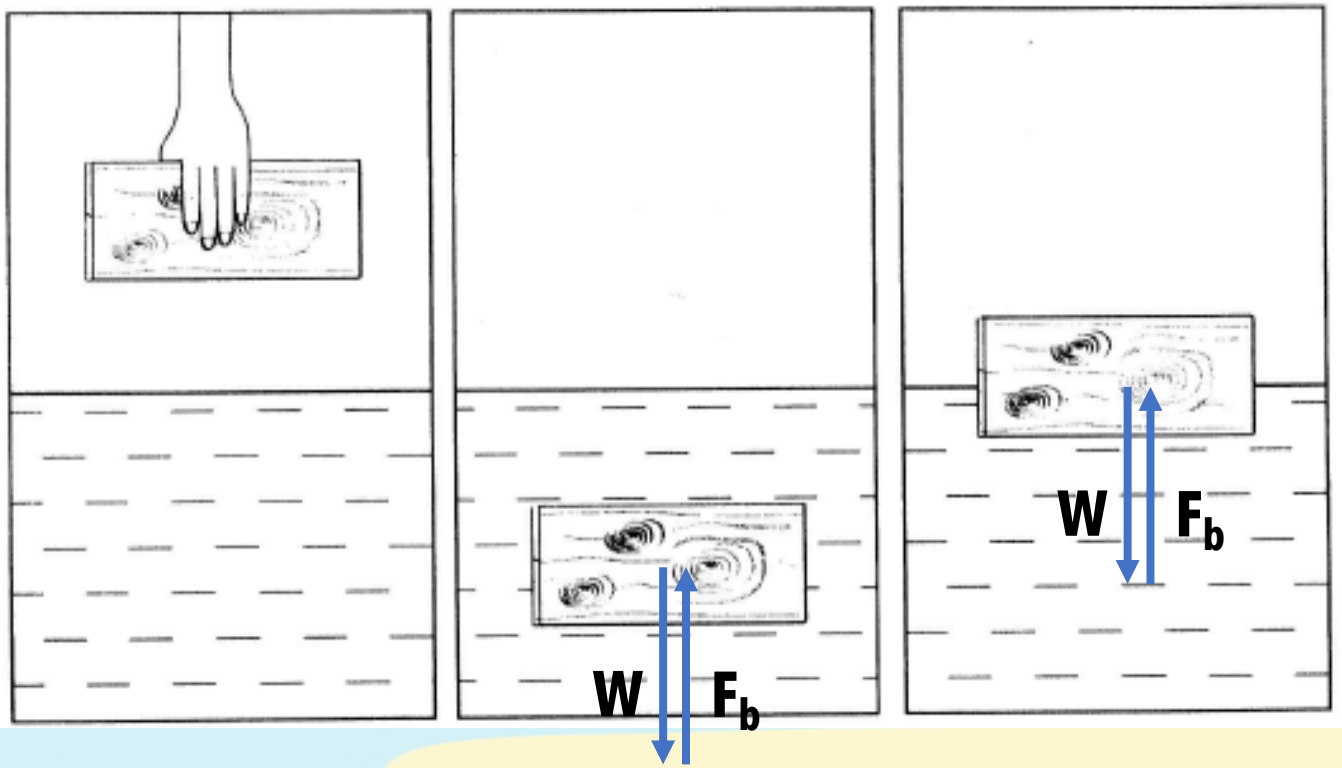


Diagram 4

Wooden block moves upwards because:

- Buoyant force > weight of wooden block
- Net force acting upward

Wooden block floats because:
buoyant force = weight of block

CHAPTER 3: FORCES & PRESSURE

Diagram 5 shows a dropper in a bottle.

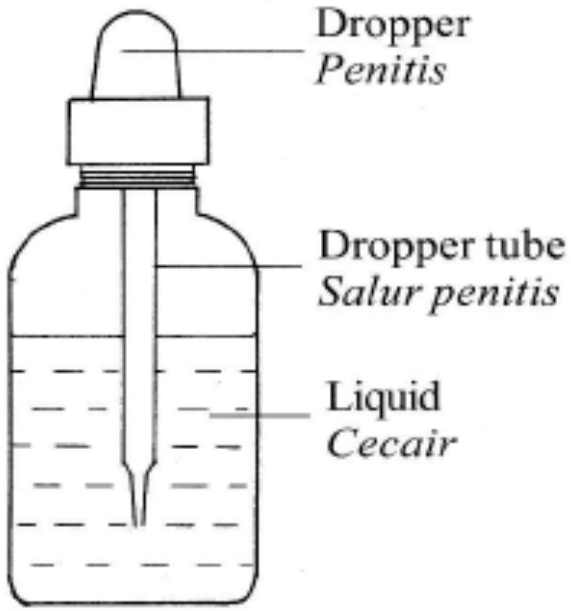
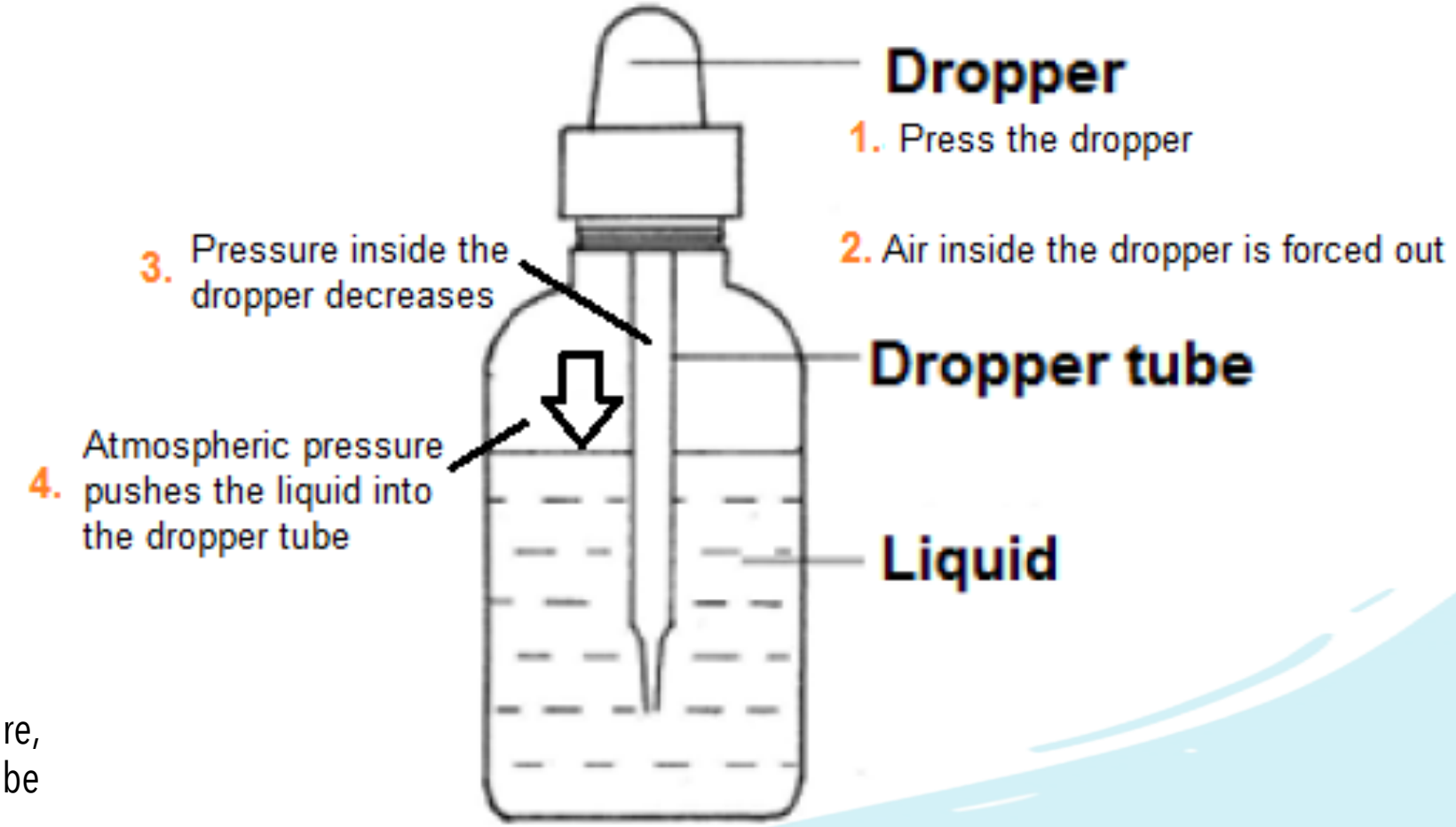


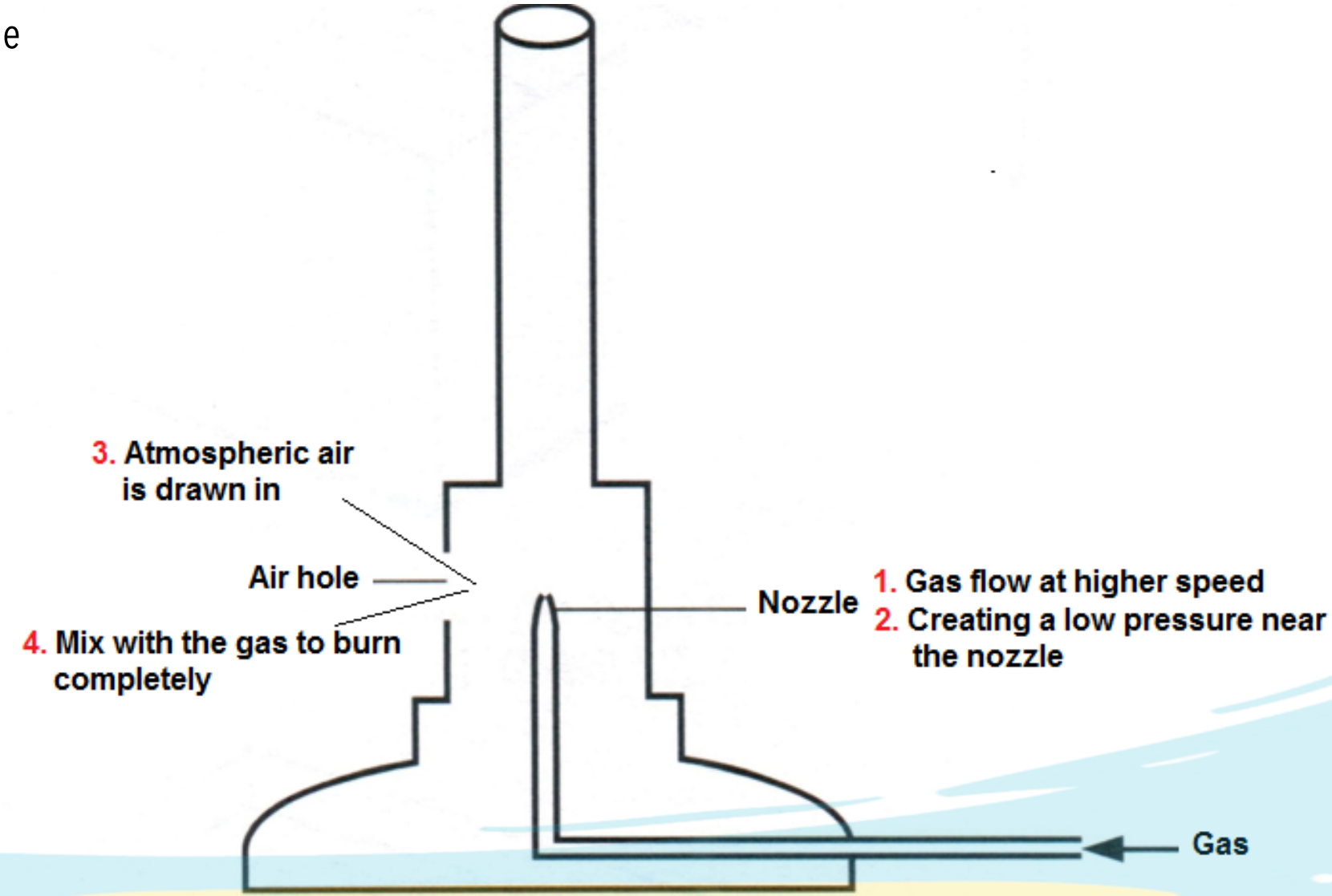
Diagram 5

Using the knowledge of atmospheric pressure, explain how the liquid in the bottle can be sucked into the dropper tube.



CHAPTER 3: FORCES & PRESSURE

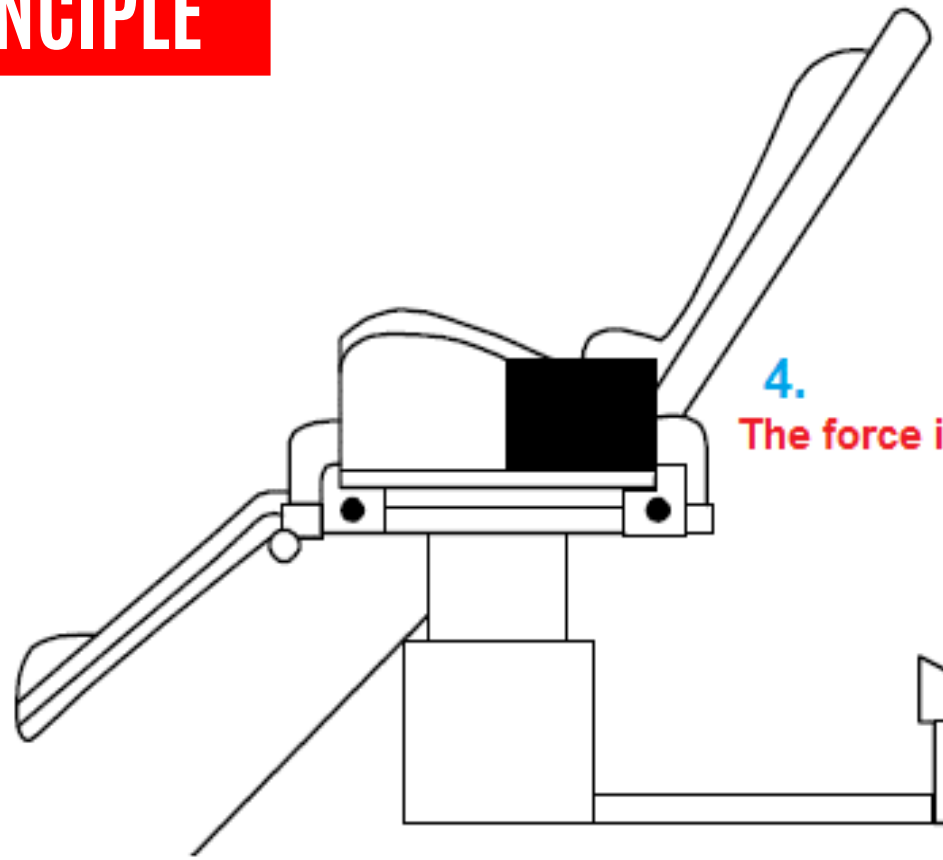
With the aid of suitable diagram, describe the working principle of a Bunsen burner.



CHAPTER 3: FORCES & PRESSURE

PASCAL'S PRINCIPLE

Explain how the chair can be lift up?



4. The force is produced and pushes the chair up

Pedal

1. When the small piston is pressed down

Big piston

Small piston

2. the pressure is exerted on the liquid and transmits uniformly to the large piston

3.

SKILL 1 - UNDERSTANDING

CHAPTER 5: LIGHT

convex mirror

Diagram 1 shows a mirror at the corner of a shop.

Diagram 1

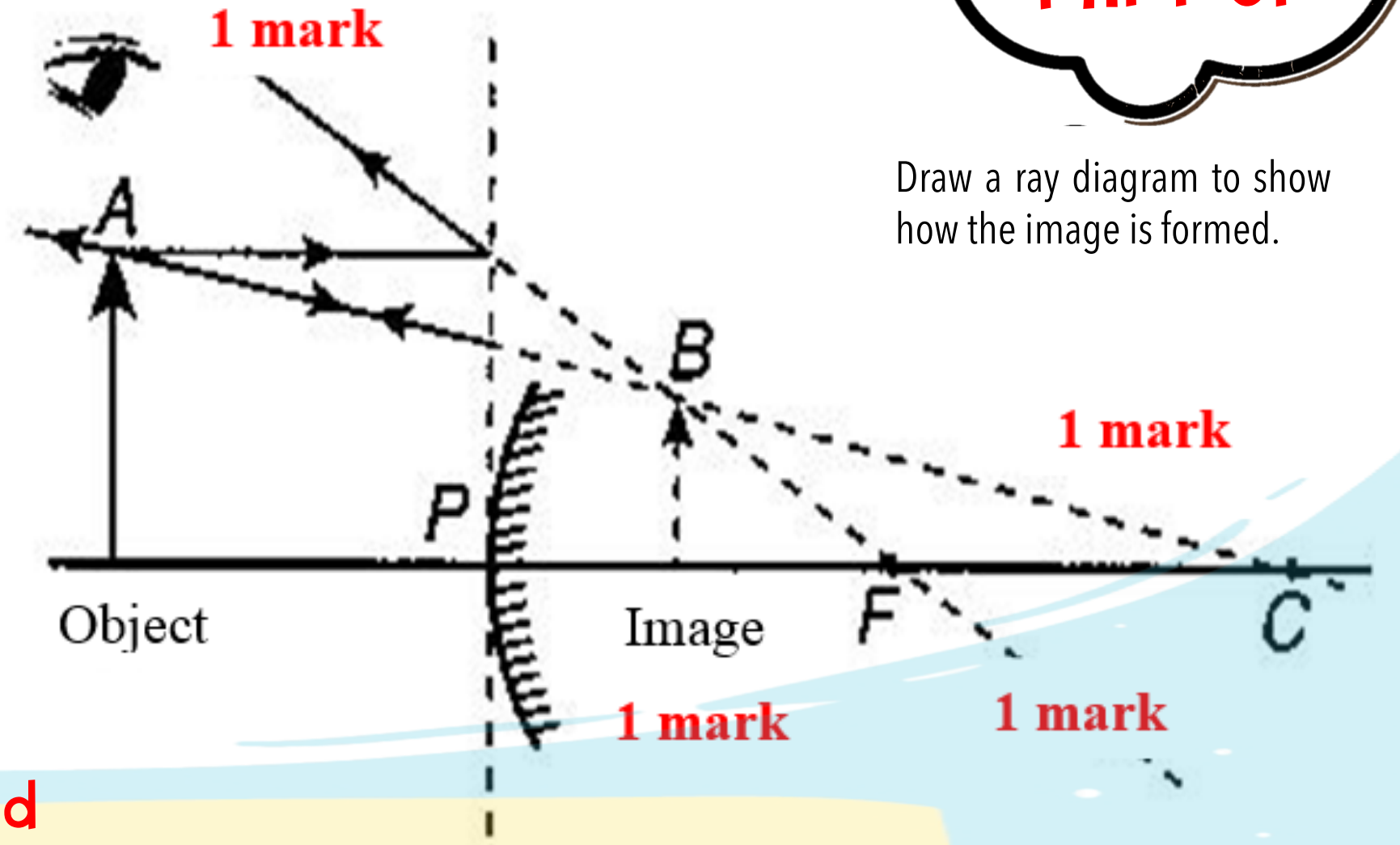
Name one characteristic of the image formed by the mirror.

V virtual

U upright

D diminished

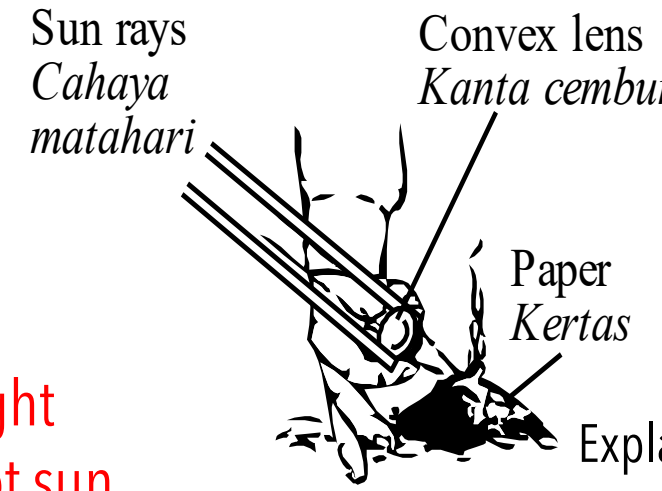
Draw a ray diagram to show how the image is formed.



SKILL 1 - UNDERSTANDING

CHAPTER 5: LIGHT

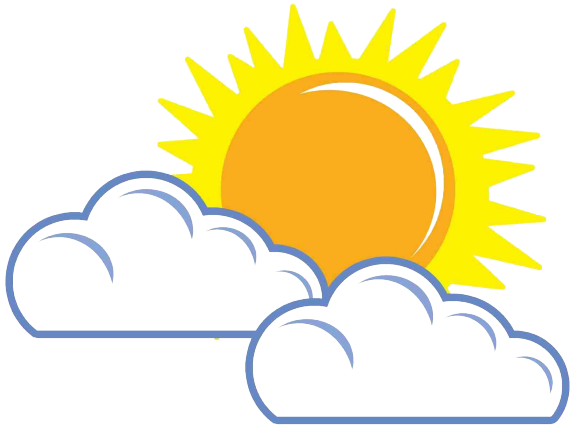
Diagram 2 shows a convex lens is used to produce fire.
The convex lens is aimed towards hot sun rays.
A piece of paper is placed under the convex lens.



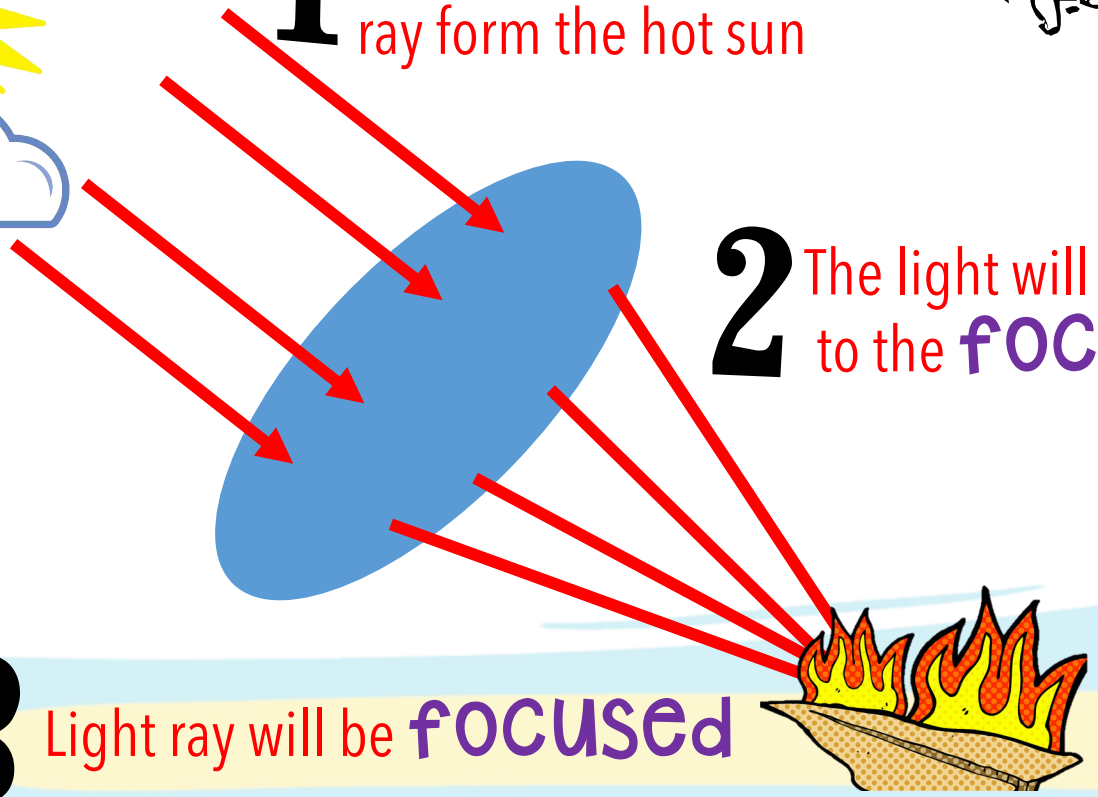
convex lens

Diagram 2

Explain how the paper burns.



1 parallel light ray form the hot sun



2 The light will converging to the focus point

3 Light ray will be focused

4 Light turns to heat to produce flame

CHAPTER 5: LIGHT

Diagram 3 shows a diamond.

Diagram 3

Explain why the diamond is sparkling when the ray of light pass through.

- A diamond has a very **high refractive index**.
- Its **critical angle** is **small**.
- The facets of a diamond are cut so that angle of incidence **greater** than the critical angle.
- **Total internal reflection** cause the diamond to sparkle.

TOTAL INTERNAL REFLECTION

CHAPTER 5: LIGHT

Diagram 4 a ray of light directed perpendicularly at a side of the semi-circular glass block.
The ray passes through the glass block to a point O before leaving the glass block.
The angle of incidence in the glass block is 30°.

Explain how total internal reflection occurs in Diagram 4?

- **Increase** the angle of incidence, i then angle of refraction, r will also increase
- Keep on increasing the angle of incidence until **angle of refraction is 90°**
- The angle of incidence is called **critical angle**
- Increase the angle of incidence **more** than the critical angle, the ray will be reflected.

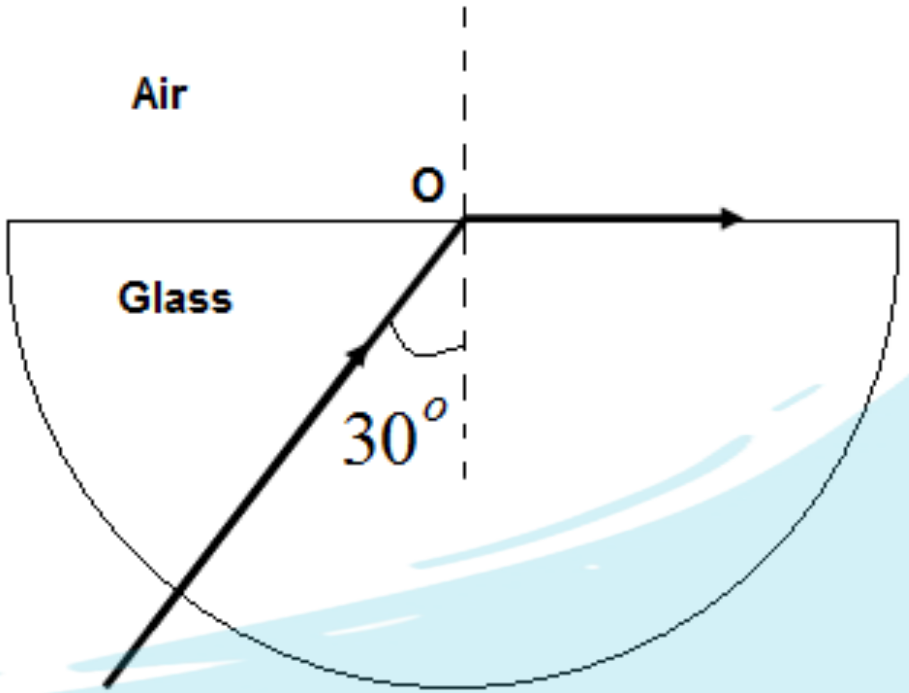


Diagram 4

TOTAL INTERNAL REFLECTION

CHAPTER 5: WAVES

Diagram 1 shows a loud speaker that produces sound waves in air.

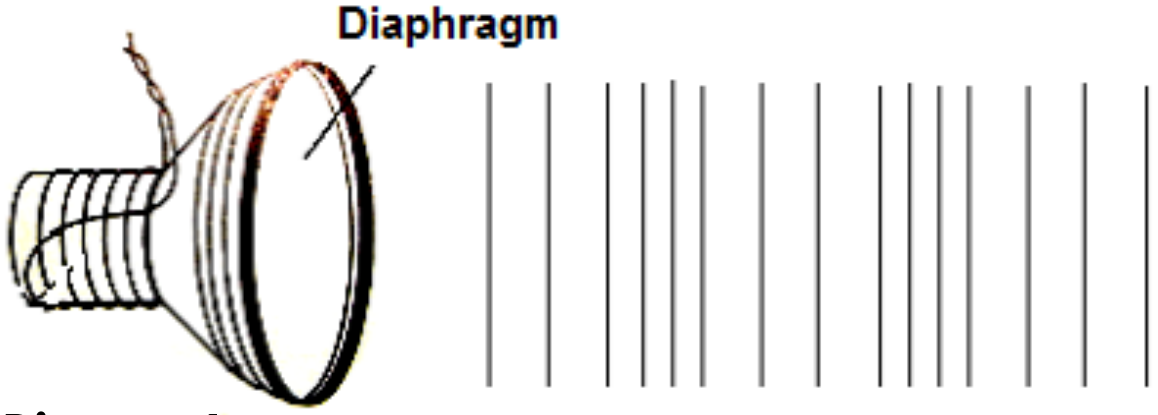


Diagram 1

Explain how a sound wave is produced.

- (When someone speaks the) paper cone will **vibrating**
  (The vibrating paper cone will vibrate) the air molecules
- When the paper cone moves to the right, it will produce a layer of **compressed** air
- When the paper cone moves to the left, it will produce a layer of **rarefaction** air
- The **series of compressions and rarefactions**
  (produces sound waves)

LONGITUDINAL WAVE

CHAPTER 5: WAVES

- ultrasonic have high frequency
- ultrasonic is high energy
- ultrasonic can penetrate into deep water
- ultrasonic can be travel far/long distance

Diagram 2 shows a submarine using a sonar system.

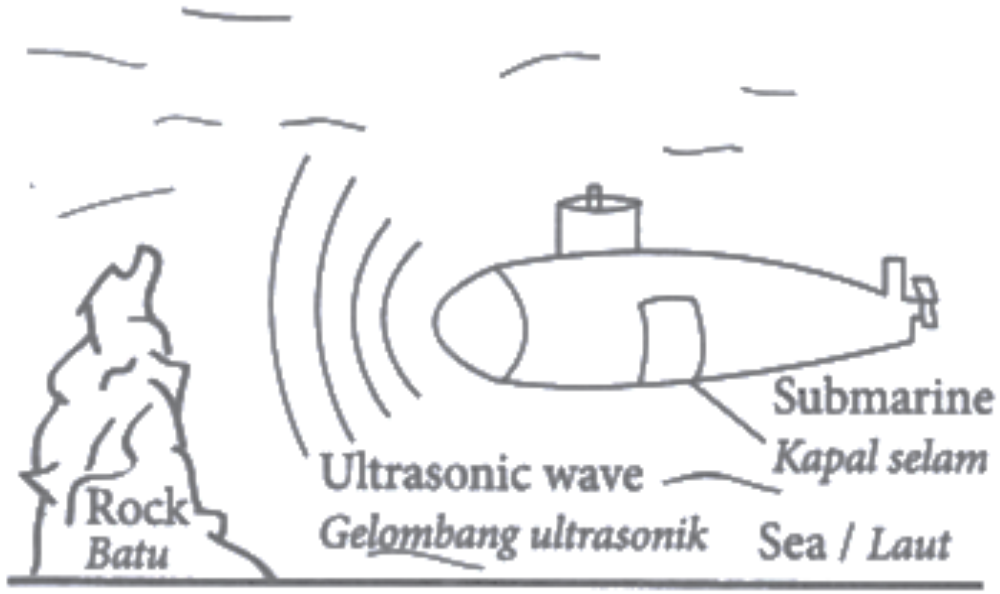


Diagram 2

Explain why ultrasonic wave is used in sonar system instead of radio wave.

REFLECTION OF WAVE

CHAPTER 5: WAVES

Diagram 3 shows that the glass breaks when the singer sings.
Explain why it happens.

- Sound wave transfer to the glass
- Glass vibrate
- Vibration of the glass achieved the natural frequency of the singer
- High amplitude produced, glass broken

Diagram 3

LONGITUDINAL WAVE

CHAPTER 5: WAVES

Diagram 4 shows another modification to the harbour to overcome the heavy sea traffic problem.
The wave pattern produced at the entrances is shown in Diagram 4.

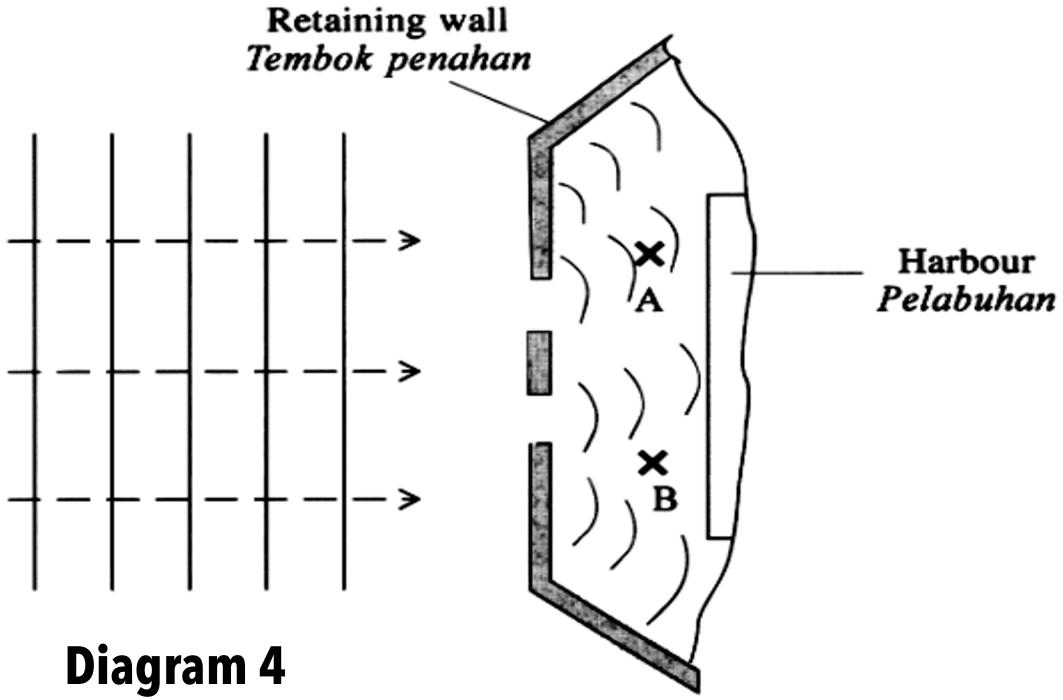


Diagram 4

Describe the movement of two similar ships that are located at A and B. Explain your answer.

Location A:

- Move up and down
- constructive interference

Location B:

- stationary // remain at rest
- destructive interference

INTERFERENCE OF WAVE

Amazing

PHYSICS

is around you

"Life isn't about finding yourself. Life is about **creating** yourself."

Follow the excellence,
the success will chase you!