Nº1

a i)
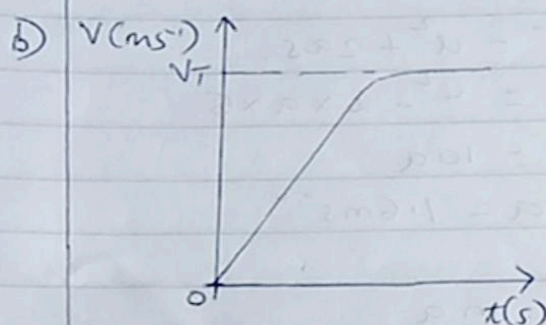- Makes a stationary body to move.
- Increase the speed of a moving body.
- Change the direction of a moving body.
- Deforms an object.
- Slows down a moving body or bring a moving body to rest.

ii)
- Gravitational force
- Electromagnetic force
- Electrostatic force.

b)

V_T — Terminal velocity.

When the metal sphere falls through oil, it first accelerates downwards until it attains a constant velocity, V_T, called terminal velocity. At this velocity, the weight of the metal sphere is equal to the sum of upthrust and viscous drag.

The sphere continues with this constant velocity until it hits the bottom of the glass vessel.

c)

from $F_R = ma$

$16 = 8a$
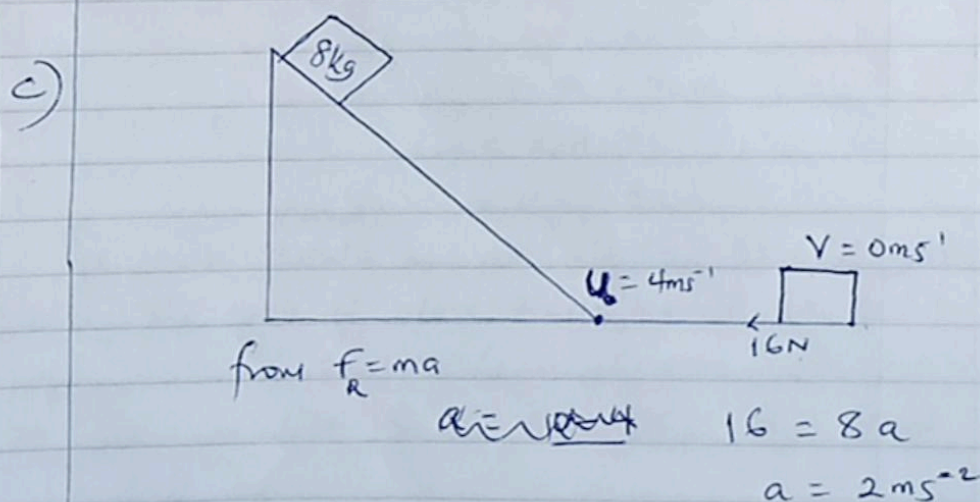
$a = 2\,ms^{-2}$

but $a = -2ms^{-2}$

from $v^2 = u^2 + 2as$.

$$0 = 4^2 - 2 \times 2s$$
$$16 = 4s$$
$$s = 4m.$$

It covers 4m before it stops.

ii)

If $s = 5m$.

from $v^2 = u^2 + 2as$.

$$0 = 4^2 - 2 \times a \times 5.$$
$$16 = 10a$$
$$a = 1.6ms^{-2}.$$

$$F_R = ma.$$
$$f_R = 8 \times 1.6$$
$$f_R = 12.8N.$$

- Friction enables machines to move without sliding.
- Friction enables/enhances the proper functioning of braking systems.

29) i) Centre of gravity is the point of application of the resultant force due to the earth's attraction on a body.

ii)
- The centre of gravity of a uniform lamina e.g a uniform rectangular lamina.

- To determine the centre of gravity of a uniform rectangular lamina, diagonals are drawn.
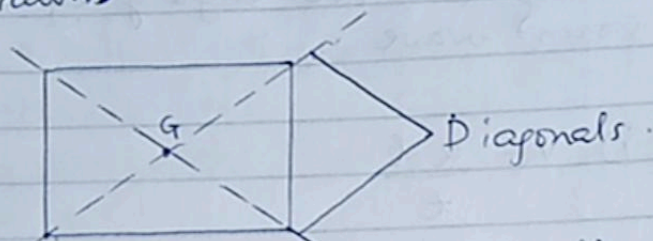
Diagonals.

- The point of intersection, G, of the diagonals is the centre of gravity

b) i) - The sum of the clockwise moment about any point must be equal to the sum of anticlockwise moments about the same point.
- The sum of forces in one direction must be equal to the sum of forces in the opposite direction.

ii)
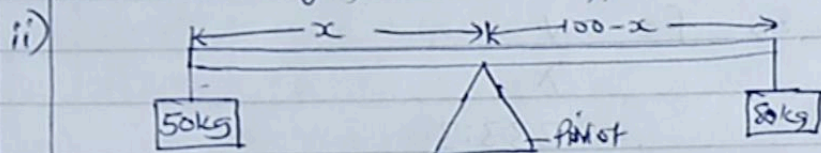
Taking moments about the pivot.
$$50 \times 10 \times x = 80 \times 10 \times (100-x)$$
$$50x = 80(100-x)$$
$$50x = 8000 - 80x$$
$$130x = 8000$$
$$x = 61.5 \text{ cm}$$
(must)
The pivot should be at 61.5cm from 50kg mass.

c) When the load is close to the ground, the centre of gravity is lowered hence increasing the stability of the forklift truck than when the load is high up.

39) i) Sound is a form of energy produced
by vibrating objects.

ii).
- The incident sound wave, reflected
sound wave and the normal at the
point of incidence, all lie in the same
plane
- The angle of incidence of the sound wave
is equal to the angle of reflection of the
sound wave.

b) i) $V = \dfrac{2d}{t}$

$V = \dfrac{2 \times 100}{0.6}$

$V = 333.3 ms^{-1}$.

ii) $100m = 10\lambda$

$\lambda = 10m$.

$V = f\lambda$

$\Rightarrow f = \dfrac{V}{\lambda}$

$= \dfrac{333.3}{10}$

$f = 33.33Hz$.

c) When temperature increases, velocity and
frequency of the wave increase and when
temperature decreases, velocity and
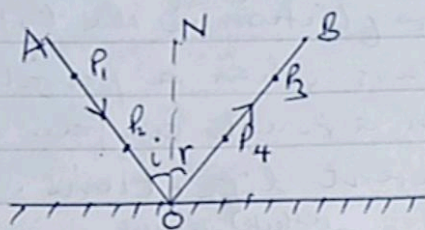frequency of the wave decrease.
Since sound is travelling in air, pressure
has no effect on both the velocity
and frequency of sound.

d)

Sound waves	Electromagnetic waves
- Are slower	- Are faster
- Can't travel through vacuum	- Travel through vacuum
- Require material medium for transmission	- Don't require material medium for their transmission

4a)

i) - The incident ray, reflected ray and the normal at the point of incidence, all lie in the same plane.
- The angle of incidence is equal to the angle of reflection. | **02**

ii)

A diagram showing rays AO and OB with pins P_1, P_2, P_3, P_4, normal N, angles i and r at point O on a reflecting surface.

- Fix a white sheet of paper on a soft board using drawing pins.
- Draw a horizontal line and draw a normal ON to it.
- Measure an angle of incidence, i, to the normal and draw the line to meet the horizontal line at O.
- Place a plane mirror vertically along the horizontal line.
- Fix two pins P_1 and P_2 vertically along line AO and locate the images using pins P_3 & P_4 so that they appear in line with images of P_1 and P_2.
- Remove the pins and draw line OB and measure angle, r.
- Repeat the experiment for different angles of incidence
- It is observed that $i = r$ in each case and all the rays lie in the same plane with the normal at the point of incidence hence verifying the laws of reflection of light. | **04**

iii) Regular reflection is the type of reflection which occurs when a parallel incident beam falls on a smooth surface and it is reflected as a parallel beam.
__where as__
Diffuse reflection is the type of reflection which occurs when a parallel incident beam falls on a rough surface and it is reflected in different directions.

Incident beam   reflected parallel beam   Smooth surface

Incident beam   Rough surface

b)

$$x = \sqrt{3^2 + 4^2}$$
$$x = \sqrt{9 + 16}$$
$$x = 5cm$$
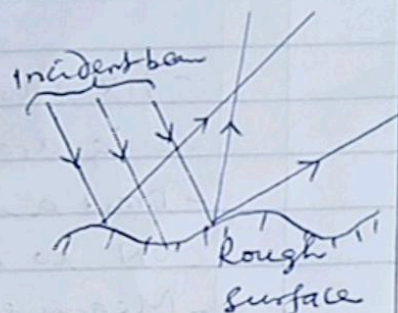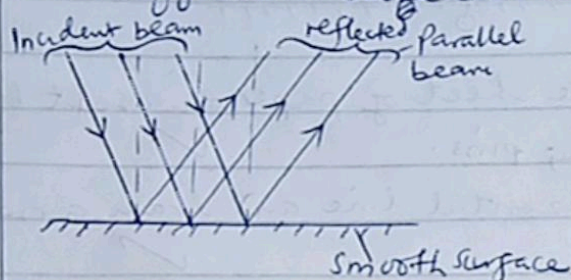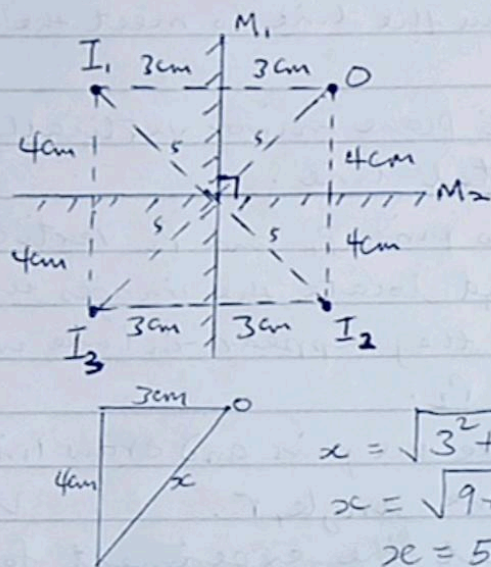
* Distance between I_1 and I_2 = 10cm.
  Distance between I_1 and I_3 = 8cm
  Distance between I_2 and I_3 = 6cm

c) Images formed by plane mirrors are
  - Virtual
  - laterally inverted.
  - Same size as the object
  - Upright.
  - Same distance behind the mirror as the object infront of the mirror.

59) i) Saturated vapour pressure is the pressure exerted by a vapour in contact with it's own liquid.

ii) Boiling point is the constant temperature of a liquid at which it's saturated vapour pressure is equal to external atmospheric pressure.

b) Addition of impurities in a liquid raises it's boiling point.

5c(ii)

Latent heat

| 1.8kg water 40°C | → | ice 0°C |

Temperature change.
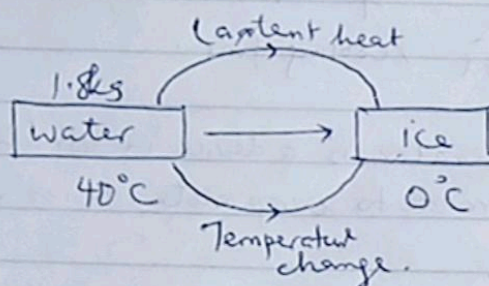
$$R = mL_f + mc\Delta\theta$$
$$= (1.8 \times 340000) + (1.8 \times 4200 \times 40)$$
$$= 612,000 + 302,400$$
$$= 914,400J.$$

$$\frac{914,400J}{200J/s}$$

$$= 4572s.$$

d) Cooking food at a very high altitude, where atmospheric pressure is low, it takes long to be ready, this is because water boils at a much lower temperature due to low atmospheric pressure.

5c (i)
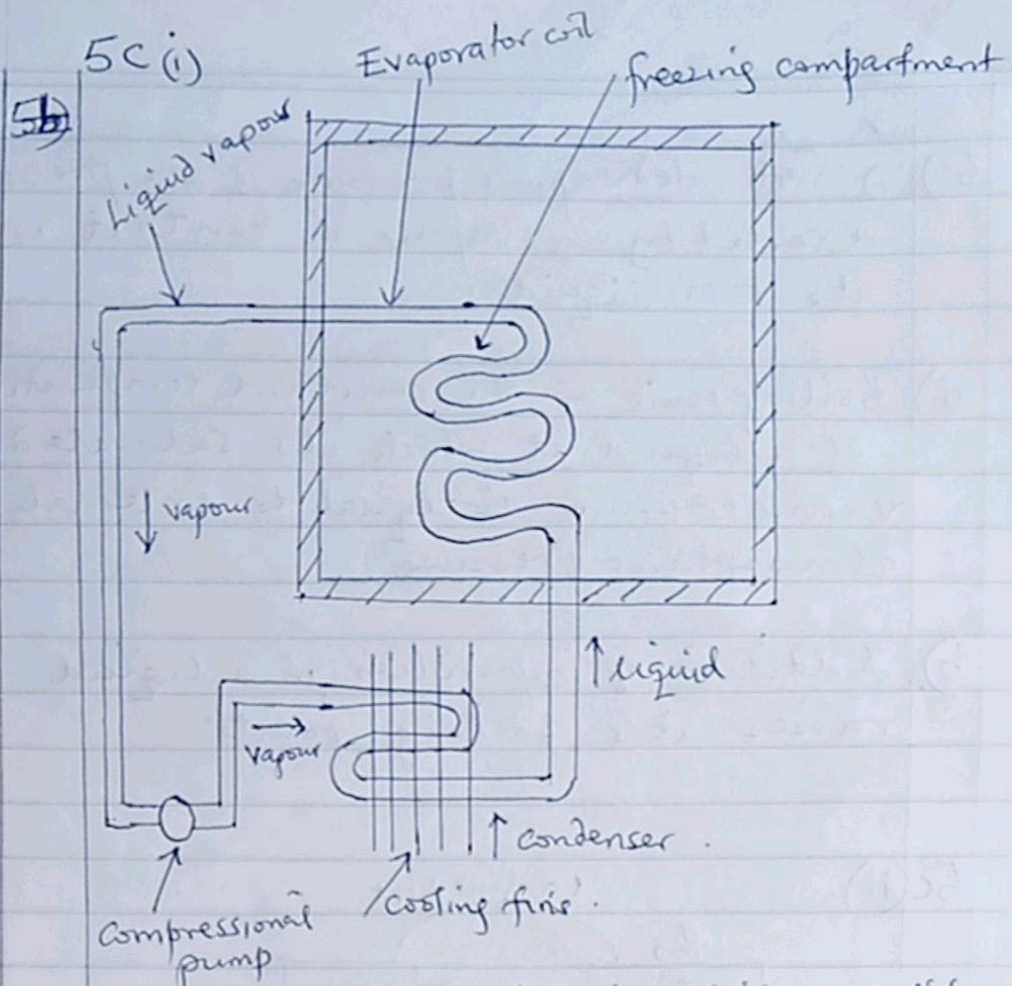
A refrigerator is a device in which a volatile liquid is made to evaporate. It is made up of 3 parts,
- The pump, freezing box and the condenser.
- The pump pumps the volatile liquid from one end to the other reducing the vapour pressure making the liquid to evaporate.
- The freezing box is the point where the volatile liquid actually evaporates and absorbs the required heat to evaporate from the foods & beverages near it.
- The condenser is where the copper coils from the freezing box are connected to the cooling fins and the vapour compressed so as to condense and enable the vapour to loose the heat to the surrounding air via cooling fins.

6a) i) Back emf is an induced emf that acts in an opposite direction to the emf applied to rotate the motor.

ii) $\quad E = 240V, \quad R_A = 5\Omega, \quad I_A = 10A.$

$$\eta = \frac{E_B}{E} \times 100\%$$

$\quad\quad 50 = 240 - E_B$

But $\quad I_A = \dfrac{E - E_B}{R_A}$

$\quad\quad E_B = 190V$

$\quad 10 = \dfrac{240 - E_B}{5} \quad E_B \Rightarrow$ Back Emf

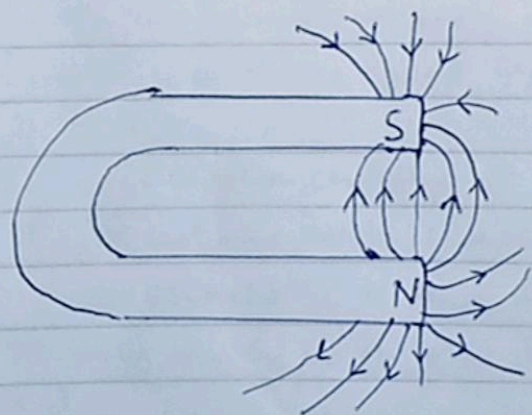$\quad \eta = \dfrac{190}{240} \times 100\%$

$\quad \eta = 79.17\%$

b) i)

The alignment of the molecular magnets changes when an alternating current is passed through it hence losing its magnetism.

ii) - By hammering the magnet several times.
  - Heating the magnet to a very high temperature.

c) i) A - South pole.
       B - North pole.

ii)

d i)

Electric energy → sound energy.

ii) - Pitch is determined by the frequency of the alternating signal set.
- Loudness is determined by the ~~ap~~ amplitude of the current passing through the loudspeaker.
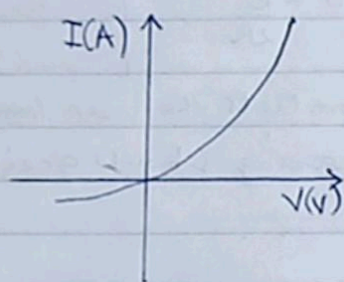
7 a)
i) Electromotive force (emf) is the total workdone to transfer a charge in a circuit in which the source (cell) is connected.
while
Potential difference is the workdone when one coulomb of charge moves from one point to another in a circuit.
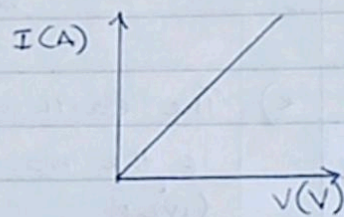
ii) Sources of emf
- Generators.
- Thermo couple.
- Electric cells.
- Solar cells.
- Crystal pick ups.

b) i) Semi conductor diode.   ii) Metal wire

c i) Advantages of a·c over d·c.
- A·c is easy to generate.
- A·c is easy to transmit
- A·c can easily be stepped up and down.

ii) Precautions when wiring a house.
- Wires must be properly insulated.
- Switches and fuses must be connected to the live wires.
- Electrical appliances should be earthed.
- Right colour codes should be used.
- There should be a fuse in the ring circuit.
- Use only one type of plug in the ring main circuit.

iii) Parallel connection ensures has the following advantages.

- Electrical appliances recieve full mains p.d.
- If one circuit is faulty, the whole supply of the house is not cut off / disconnected.

d)
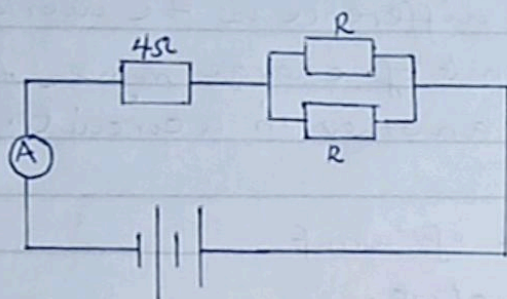
$$I = 2A. \qquad r = 1\Omega, \qquad E = 12V.$$

$$E = I(R+r)$$

$$12 = 2\left(4 + \frac{R^2}{R+R} + 1\right)$$

$$6 = 5 + \frac{R^2}{2R}$$

$$12R = 10R + R^2$$
$$R^2 - 2R = 0.$$
$$R(R-2) = 0$$
$$\underline{R = 2\Omega}$$

e) The earth wire protects the user from an electric shock if the metal casing should accidentally become live.

8a) X rays are electromagnetic waves of short wave length which are produced when cathode rays are stopped by a metal target.

b i) Properties of X-rays
- Carry no charge.
- They are not deflected by both magnetic and electric fields.
- They travel in a straight line.
- They readily penetrate matter.
- They affect photographic films.

ii)

Cathode rays	X-rays
- Negatively charged	- Have no charge
- Travel at low speed	- Travel at high speed
- low penetrating power	- High penetrating power
- Deflected by both magnetic & electric fields	- Not deflected by both magnetic & electric fields

Similarities
- Both travel in straight lines.
- Both cause fluorescence when they strike matter.
- Both ionise air and gas molecules.

c) i) A - cooling fins.
   B - Metal target.

ii) C - Hot filament.
   It produces electrons by thermionic emission.
   D - Rheostat
   It allows adjustment of current in the filament of the x-ray tube.
   or To vary current in the filament of the x-ray tube.

iii) High voltage is to accelerate the electrons to the tungsten/metal target.

d)
   - They destroy living cells in the body.
   - They damage blood cells and eye sight.
   - They cause genetic changes (mutation)
   - They cause cancer after excessive exposure
   - They cause skin burns.

c)   - Never over expose your body to X-rays
- Always stand behind thick walls of concrete.
- Always cover the x-ray tube walls with lead shields to prevent stray x-rays.
- Keep large distance between X-rays source and people.
- Soft X-rays should be used on human tissues.