Item 1

a) The stage was lit with red light, therefore yellow dress absorbed yellow red light and reflected red. Blue dots absorbed all the red light and reflected non.

b) $t = 0.055$, $V = 320$

Distance = speed × time

$= 320 \times 0.05$

$= 16m$

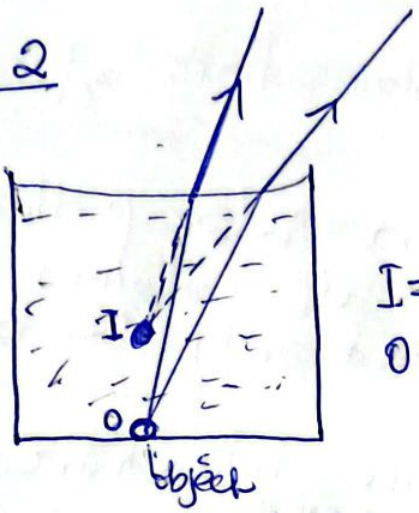
He was sitted 16m away from the nearest loud speaker

c) Second sound is echo.

minimised by - covering the walls with soft materials
- Putting curtains in the hall.
- Covering the floor with soft carpet.
- Putting chairs in the hall with soft cushions.

Item 2

(a)



I = Image
O = object (bottom of the swimming pool)

- As the ray of light moves from the bottom of the swimming pool, it undergoes refraction at the water air boundary.
- The rays are refracted away from the normal and so the point O which is at the bottom of the swimming pool will appear be seen raised to point I as the refracted rays enter the eye.
- This makes the swimming pool appear shallow hence causing a deceptive look on the depth of the pool.

b)
- Soft wall and curtains absorb most of the sound incident on it.
- The reflected sound is minimised in the hall, this also minimises on the reberveration hence the sound becomes clear in the hole.

c) - White lights is a mixture of Blue, Green and Red.
- The person entering through the gate while putting on any colour of cloth will absorb all the colours in white light and reflects the in the cloth
- This makes identification of the individual correct

Item 2

c) ~~White~~

- White light is a combination of all Colours.
- The cloth of any person entering through the Gate will absorb all colours in white light and reflect only the one in the cloth.
- This results into true identification of the Colours of the Clothes of the People entering by the security personel.

- The decoration of individuals is attained inside the hall by using bulbs of coloured lights
- When coloured light falls on the person, the appearance will depend on the light falling and the cloth worn.
- As the lights keep changing, the appearance of the person and the wall also keeps changing. This will act as a good decoration inside the hall.

Item 3

a) Original Count rate = 250 Counts per second.

Background Count rate = 50 Counts per second.

True original Count rate = (250 - 50) Counts per second

= 200 Counts per second

Counts per second remaining	Time taken (days)
200	0
100	2
50	4
25	6
12.5	8
6.25	10

NB: The learner plots a graph of Counts per second against time and using 10 counts per second, the time is obtained.

b) The material can cause :-

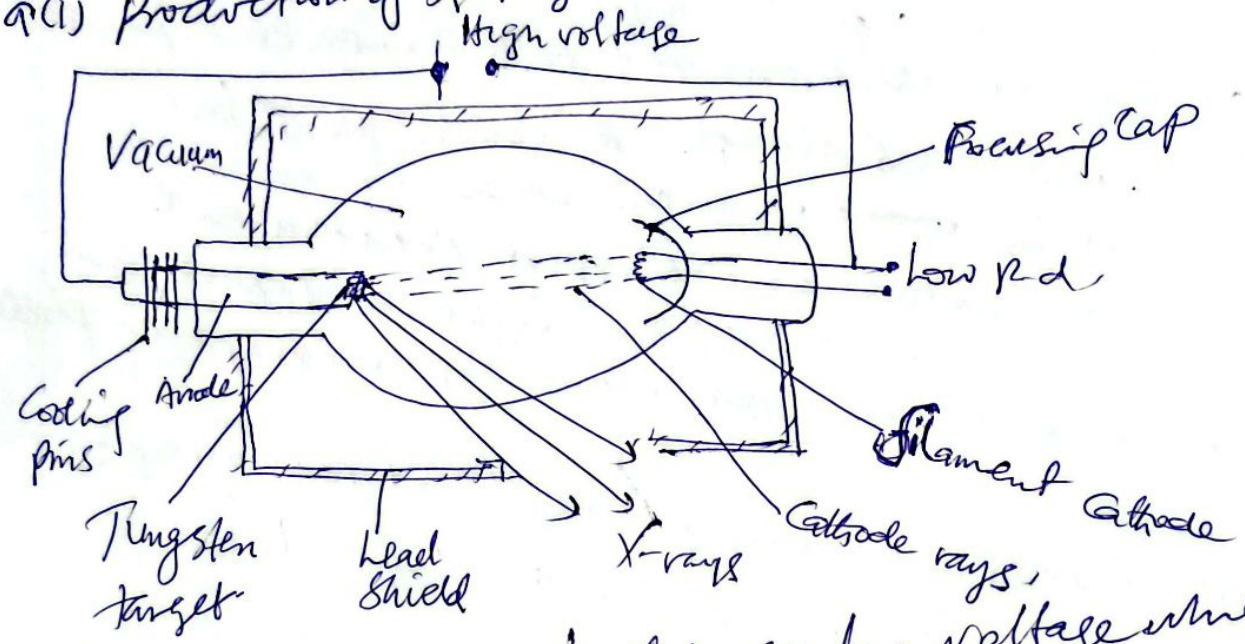
- cancer
- Damage of eye sight
- Mutation of the genes
- burning of deep lying cells.

c) The material should be:-

- handled using long pair of tongs
- Stored in thick lead containers
- Avoided the exposure unnecessarily
- Avoid eating or drinking in their Presence
- wounds need to be covered before using radioactive source.

Item 4

(a) Production of X-rays



- Cathode filament is heated using low voltage which emits electrons by thermionic emission
- Electrons are accelerated by high voltage at the anode towards the target.
- Focusing cap focusses the fasting moving electrons to the target.
- when fasted moving electrons hit the target, they are brought to rest, and most of their K.E is converted to heat (99%) the rest to X-rays.

Health hazards of X-rays

- Destroys living cells in our bodies
- Causes genetic mutation
- Causes sterility
- Damage eye sight
- Causes cancer.

Item 4

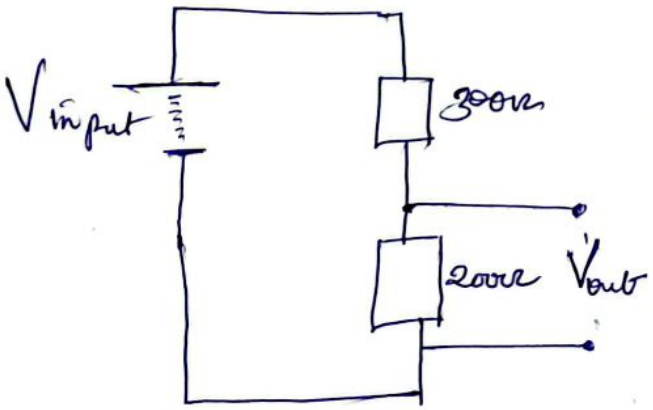
a(ii) – ~~The flow~~

- The photographic film/plate is placed behind the suspected part of the body
- X-rays are then directed to the suspected part.
- X-ray will pass through ~~the~~ broken part but absorbed by ~~bones~~ unbroken bones.
- When the photographic plate is treated out, unbroken part will appear light and broken parts will appear dark on a photographic plate.

NB

Soft X-rays are used for medical radiography.

(b) By using a potential divider as shown below;



Total resistance

$R = 300 + 200 = 500$

current in circuit.

$V = IR$

$I = V/R = \frac{10000}{500} = 20A$

P.d across 300Ω,

$V = IR$

$= 20 \times 300 = 6000V$

P.d across 200Ω

$V = IR$

$= 20 \times 200 = 4000V$

He should connect the two resistors in series with 10kV and the out put voltage to the machine across 200Ω resistor which like give 4kV.

Item 5

(a) - Different seasons at the same time of the year is caused by tilting of the earth about its own axis and rotation of the earth around the sun.

- Side tilted towards the sun experience summer while side tilted away experiences winter season.
- Rotation either takes the earth near the sun or far from the sun resulting late change of season. So seasons can be different in different parts of the earth depending on the tilt and rotation

(b) - By use of an artificial weather satellite.

- The satellite is launched into a geostationary orbit, they remain appearing stationary with respect to the earth, record and transmit images of the entire hemisphere continuously using sensors which are analysed and interpreted by the meteorologists.

(c) - Tilt and rotation of a particular part of the Earth faces the sun twice in a year as the earth revolves about the sun.

ITEM 6

(a) – In a certain season, as the earth rotates around the sun, the Northern hemisphere is tilted towards the sun at 23.5°, receiving the glare of the sun's rays for a longer time than the night time
– London being at the Northern hemisphere therefore some days can be longer than night as in 16 hours of day and 8 of night

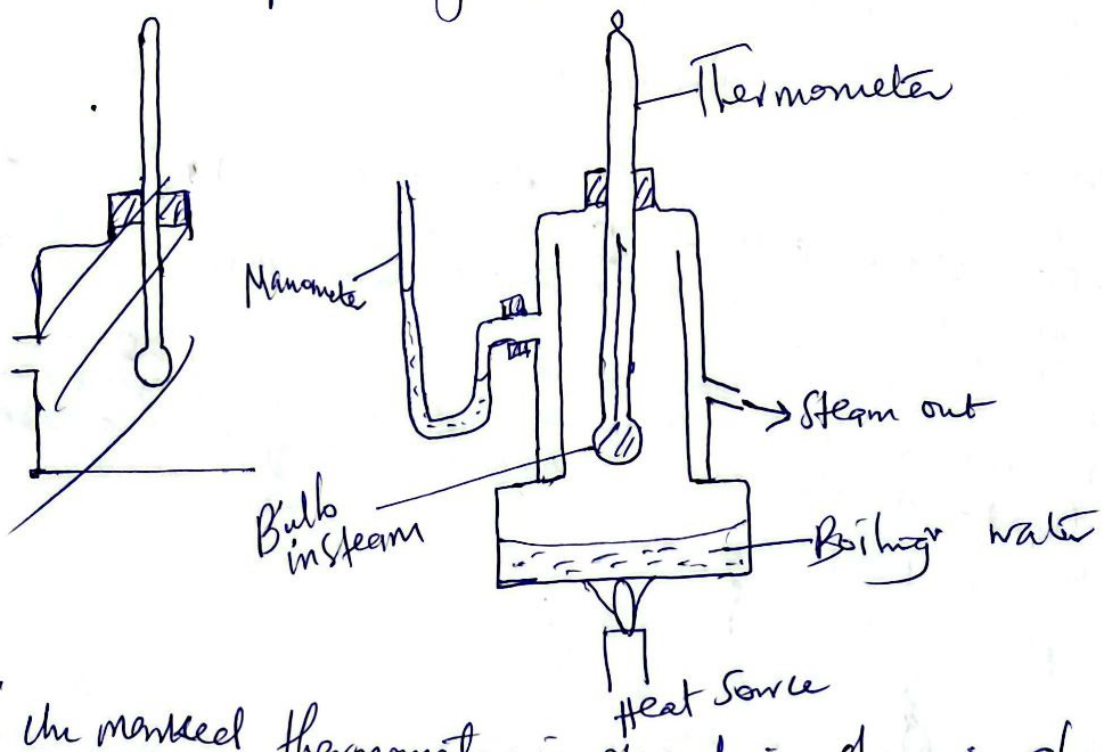
(b) – The stars are in the sky both at day and night.
– During day, the bigger star, the sun makes the sky bright that we cannot see the much dimmer (smaller or distant) stars.
– At night, when the sky is dark, the light of the stars can therefore be seen.
– ~~Also reflection of light from the sun~~

(c) – The moonlight we see is actually the sun's light reflected off the the lunar surface.
– As the moon orbits the earth, the sun lights up different parts of it, making it seem as if the moon is changing in shape.
– ~~So~~ our views of the reflecting part at a given time accounts for the changing shape of the moon.

Item 7

9 (i) – Should be good conductor of heat
– Opaque
– expand uniformly.
– Should not wet glass / not stick to the glass
– Should have high boiling point and low freezing point
– Readily available.

(ii) – upper fixed point is first determined as follows



– The thermometer is placed in steam in a hypsometer
– The Mercury thread rises until the point is reached when it becomes constant.
– This point is marked on the wall of the thermometer, this becomes upper fixed point.

Lower fixed Point

– The thermometer is placed in pure melting ice in a filter funnel.
– The mercury thread drops until it becomes constant, this point is marked on the wall of glass.
– This becomes lower fixed point.

Item 7

Graduations / Scales

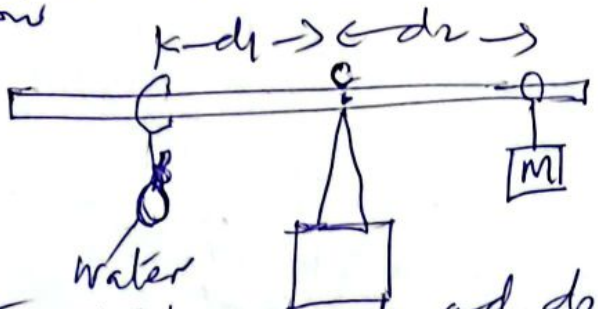
- The difference between the upper fixed point and lower fixed point is measured and recorded.
- This distance is divided into 100 equal divisions, this gives us the Scale and each division is called a degree.

(b) Materials

- metre rule
- 1 Standard mass M
- Liquid tied in a polythene ($5\,cm^3$)
- Knife edge
- wooden blocks
- Two threads of about 30cm

Procedures

- The metre rule is balanced on the knife edge and its balancing point C noted.
- Known mass is suspended from one side of the metre rule.
- The liquid is suspended from the opposite side of the metre rule and its position adjusted until the metre rule balances again as shown below



- The distances d_1 and d_r are read and recorded
- Using the principles of moments, the mass of the liquid is got from, $M_0 = \frac{M d_r}{d_1}$, M_0 = Mass of the liquid.

- The density of the liquid $= \frac{m_0}{V} = \frac{m_0}{5}$

$= \left(\frac{M d_r}{5 d_1}\right) g\,cm^{-3}$.

Item 8

a(i) $p = h\rho g$

$4000 = h \times 1000 \times 10$

$h = 4M$

The tank should be raised to a height of 4m above the ground for water to flow to the taps with a pressure of about 40kPa.

(ii)

Height = No of steps x height of each step.

$4 = n \times 0.4$

$n = 10$ steps

The ladder will require 10 steps.

(b)

- A small piece of the material is cut and its mass M_s measured and recorded.
- The piece is then heated to a known temperature θ_2
- The piece is quickly transfered to a copper calorimeter of known mass M_c and specific heat capacity c_c containing water of mass M_w at a temperature θ_1
- The mixture is well stirred until a maximum temperature, θ is reached
- Assuming no heat losses to the surrounding,

Heat lost by piece of cut = Heat gained by water + Heat gained by the calorimeter

$$M_s C_s (\theta_2 - \theta) = M_w C_w (\theta - \theta_1) + M_c C_c (\theta - \theta_1)$$

$$C_s = \frac{M_w C_w (\theta - \theta_1) + M_c C_c (\theta - \theta_1)}{M_s (\theta_2 - \theta)}$$

C_s is specific heat capacity of the piece

If the value of C_s is between $850 J kg^{-1} K^{-1}$ and $900 J kg^{-1} K^{-1}$ then it will be suitable for use as pipes.

Item 9

a) – A sample of milk is picked from a given supplier
– Its mass, m, is measured using a beam balance.
– The volume V of the milk is then measured and recorded by pouring it in a measuring cylinder.
– The density of milk, ρ, is calculated from, density $= \frac{\text{mass } (m)}{\text{volume } (V)}$
– If the density is approximately $1035\ kgm^{-3}$ then the milk from that supplier is pure.

b) Heat withdrawn = heat lost by milk in dropping temp from 24°C to 10°C

$= mc\Delta\theta$

$V = 5 \times 20 = 100L = 0.1m^3$.

$\rho = 1035\ kgm^{-3}$

$m = \rho V$.

$= 1035 \times 0.1$

$= 103.5\ kg$.

Heat withdrawn $= 103.5 \times 3.14 \times (24 - 10)$

$= 4549.86\ J$

ITEM 10

(a) - Using a Pulley

A Pulley is mounted above the well. The rope is threaded through the Pulley and attached to a bucket of water in a well, the free end of the rope is pulled; this allows the bucket to be lifted upward from the well.

(b) - Using light materials for making the machine
- Lubricating the movable parts.

(c) Heat Supplied = Heat to raise temp of water + Heat absorbed by Saucepan.

$= M_w C_w (90-24) + M_s C_s (90-24)$

$= 10 \times 42000 \times 66 + 2 \times 900 \times 66$

$= 2890800\ J$

The family used 2890800 J of heat energy to boil drinking water.

ITEM 11

(a) - Power is transmitted as alternating current and consumed as direct current majorly.
- Alternating current ~~by, less etc~~ can be transmitted across long distances at a high voltage with minimal energy loss
- Alternating current is easy to generate and step up. So it's the most efficient means of transmission

(b) - Current taken into the house is higher than the one transmitted.
- Voltage taken into the house is lower than the voltage transmitted.
- This is achieved by use of a step-down transformer, which gives the current as

$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$

$$\frac{13 \times 10^3}{240} = \frac{I_s}{0.05}$$

$$I_s = \frac{13 \times 10^3}{240} \times 0.05$$

$$= 2.7\ A$$

The current taken into the house is 2.7 A

(c) - This was achieved by use of a step down transformer.
- This has the number of ~~coils~~ turns in the secondary coil lower than the number of turns in the primary coil
- Reducing the voltage output from an initial high input.

(d) - Rubber being an insulator provides electrical insulation which protects from shock of electricity
- Other reasons; durability, flexibility, grip.

Item 12

(a) i. - Power being transmitted has a very high voltage (15 KV).
- The current is alternating in the main transmission line
- This easily destroys appliances and burns the house.

ii - He can get power safely by getting power from a transformer (step down) and a fuse connected in the main switch.

ii - Bulbs be connected in parallel

- Reasons; - Failure of one bulb does not affect another
- Bulbs receive the same voltage as the source.
- Enables switching on and off independently

(b) Power Consumed $= (4 \times 0.06 \times 8) + (2 \times 0.1 \times 14) + (1 \times 0.12 \times 20) + (1 \times 0.3 \times 20) + (1 \times 0.6 \times 4)$

$= 15.52$ KWh

Total Cost = Power Consumed X Unit Cost

$= 15.52 \times 550$

$=$ U Shs. 8,536.

(c) - Regular inspection of devices
- Clearing trees under the line of power.
- All wires should be insulated.
- Earthing should always be done

Item 13

(a) - By installing a lightening conductor in the building; this consists of a copper strip with spikes outer and a copper plate burried in the ground.

Working

- When a negatively charged cloud passes over a lightening conductor, positive charges are induced on the spikes and negative charges repelled to the ground.
- Due to high charge density at the spikes, the air around the spikes is ionised and negative ions are attracted to the spikes to neutralize some positive charges. The positive ions are repelled to the clouds to neutralize some negative charges in clouds.
- The charges are then easily conducted to the ground and neutralized. This protects the building from lightning.

(b) - Avoid taking shelter under tall trees when its raining
- Putting on rubber shoes.
- Avoid using umbrellas that have pointed metal tops
- Avoid talking on phone while its raining

(c) $P = \frac{V^2}{R}$

$= \frac{240^2}{480}$

$P = 120\ W$

$V = IR$

$240 = I \times 480$

$I = 0.5\ A$

The fuse is having a rating of 120W, 240V.

The fuse got burnt down because of more than 0.5 A passed through it.

Item 14

(a) - Voltage is changed from 13 KV to 240V using a step down transformer
- This transform has more turns in the primary coil than the turns in the secondary coil
- When 13 KV of voltage is fed in to the primary coil, the alternating current creates a changing magnetic field in the primary coil which induces an emf in the secondary coil.
- The induced emf depends on the changing flux and the number of turns in the secondary coil.
- Therefore a smaller voltage is obtained from the secondary coil.

(b) - Resistance of a conductor is indirectly proportional to the cross-sectional area.
- The resistance of a wire decreases as the cross-sectional area increases.
- Therefore thick wires offer low resistance to the flow of current. That is why thick aluminium wires were used.
- Also aluminium is a good conductor of electricity.

(c) - They can be connected in Parallel
- Reason given in Item 12(a)(ii)