ST. JULIAN HIGH SCHOOL, GAYAZA
GRAND O' LEVEL PHYSICS SEMINAR 2025

Theme:
"Demystifying the Physics of the New Lower Secondary School "

MARKING GUIDE

Key Activities:

➢ Scenario interpretation skills

➢ Physics Theory Answering techniques

➢ Physics Practical Answering techniques

➢ Learner- Centered Discussions

Date: 14th June 2025

Venue: Main Hall

Time: 8:00 AM – 5:00 PM

Organized by:

Department of Physics

St. Julian High School, Gayaza

"Unlocking the mysteries of the universe through science, thought, and innovation

Item one

The workers were wear safety wear like. gloves, gas masks, lead jackets, radiation meters because radioactive materials are dangerous and can cause low body Immunity, Skin irritation, headaches, Cancer

The safety measures are to protect them from the dangers.

Nuclear materials e.g. Uranium-235 produce energy through a process called nuclear fission when they are bombarded with neutrons according to:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n + energy$$
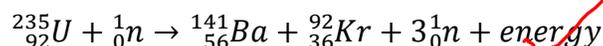
The energy produced is heat energy in very high amounts

The heat is used to boil water which produces steam at very high pressures.

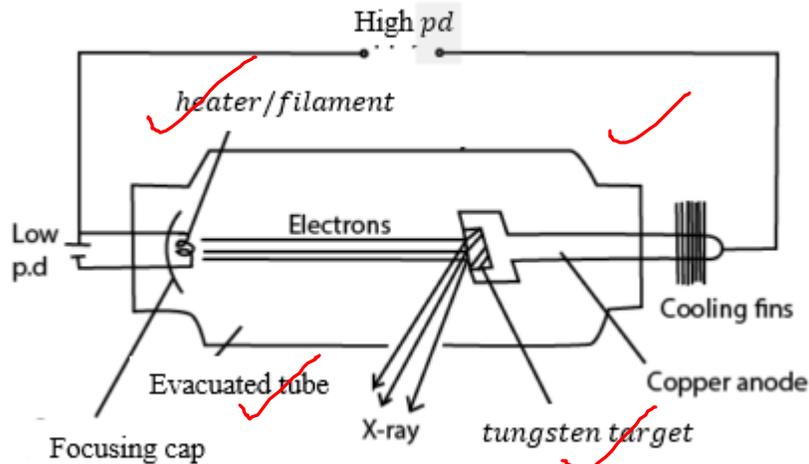The steam is used to run turbines connected to generators that produce electricity.

Mass present(g)	Time(weeks)
1000	0
500	2
250	4
125	6
62.5	8
31.25	10

At 8 weeks, the mass present is 62.5g

The replacement will be required after 8 weeks.

Item two

Cathode rays are produced by thermionic emission when a filament is heated by a low voltage source.

They are accelerated by the a high pd between the cathode and the anode.

99.9% of their energy are converted to heat energy while 0.1% is converted to X-rays.

The heat energy-produced is conducted away to the copper rod and finally to the cooling fins.

The bags to be examined will be placed in the area between the lead shield, exposed to the X-rays

and displayed on a screen or photographic plate

In order to ensure safety, the right wavelength. of X-rays should be used.

$$V = f\lambda$$

$$3 \times 10^8 = f \times 5 \times 10^{-9}$$

$$f = 6 \times 10^{16} Hz \ (soft \ x - rays)$$

$$V = f\lambda$$

$$3 \times 10^8 = f \times 0.1 \times 10^{-9}$$

$$f = 3 \times 10^{18} Hz \ (Hard \ x - rays)$$

Since hard X-rays have a higher frequency than soft X-rays, they have more energy and are more penetrative making them suitable to be used in checking bags while the soft X-rays are used for examining the people.

The hard x-rays could also pose dangers like cancer, killing body cells, sterility, causing radiation burns on the skins of the people.

The precautions that can be taken include;

➢ Wearing lead jackets. "
➢ Reducing exposure time to them.
➢ Using the right kind of x-rays.
➢ Covering all the open wounds with woolen clothes

Item three

(a) The sky was dark because of rotation of the earth. As the earth rotates, the part facing away from the sun has no light hence being dark.

The stars had varying colour and appeared in blue, white, yellow and red.

The difference in colour is due to them having different surface temperatures. The hottest are blue followed by white, yellow and red in that orders

They are also determined by how much hydrogen in the stars. Those with more hydrogen have higher temperatures.

The brightness of the stars is determined by

• The size of the stars. Bigger stars appear brighter than smaller ones

• The distance from the earth. Stars that are close to the earth appear brighter than those away from the earth.

They start-off as massive clouds of dust and gas called Nebullae.

Over time, gravity pulls the nebulla together forming proto Star.

As the proto star contracts, it heats up until about 10 million °c leading to nuclear fusion.

At this point, the hydrogen atoms fuse forming helium forming a main sequence star which reaches stability when the outward pressure from. Fusion balances the inward pull of gravity.

The variation of appearance of the moon is because the moon. is a non-luminous object and reflects light from the Sun.

Also the moon orbits the earth in an elliptical path.

As it moves, the angle at which light strikes the surface of the moon keeps varying.

This leads to various appearances like the new moon, waxing crescent, first quarter, waxing gibbous, full moon, wanning gibbous, third quarter, wanning Crescent in a sequence of phases that occurs in a 28-day cycle.

The rise and fall of water levels is because of. ocean tides. They are caused by the gravitational attraction of the moon on all large masses of water on earth.

When the moon is close to the earth, the areas closest and furthest from the moon. bulge leading to an increase in water levels making the coast line move inland and then recede.

The difference in seasons was caused by the revolution of the earth and its inclination towards the sun.

As the sun revolves, areas that are directly facing the Sun have longer days than nights, experiences high temperatures and have dry seasons.

Those facing away from the sun have shorter days than nights, experience have lower temperatures and are in wet seasons.

Areas in the tropics have the fun overhead them, and therefore have two seasons i.e. the wet Season and dry season. These close to the poles do not have the sun overhead and therefore have four seasons i.e. summer, winter, autumn and spring

(b) It is possible to make a telephone call to another country by the use of satellites.

When a telephone call is made, it is changed into digital form (electrical signals).

The digital electric signals are sent to a ground station where they are uplinked to a satellite.

The satellite receives the signals, amplifies them and sends them (down link) to a ground station in the recipient's Country.

The ground station then sends the signals to the recipient's phone.

Item four

(a) The moon is only visible at night due to the rotation of the earth. During day time, that area is facing the sun and therefore receiving day light. The moon will not be seen because there'll be enough light.

At night, the sky will be dark since that area will be facing away from the sun

The moon will. however, be seen because it will be reflecting light from the fun.

(b) The restaurant needs to set up an automatic door opening system that uses an OR gate

It is set to open and close the door when either a remote is pressed (A) or the logic gate is activated (B)

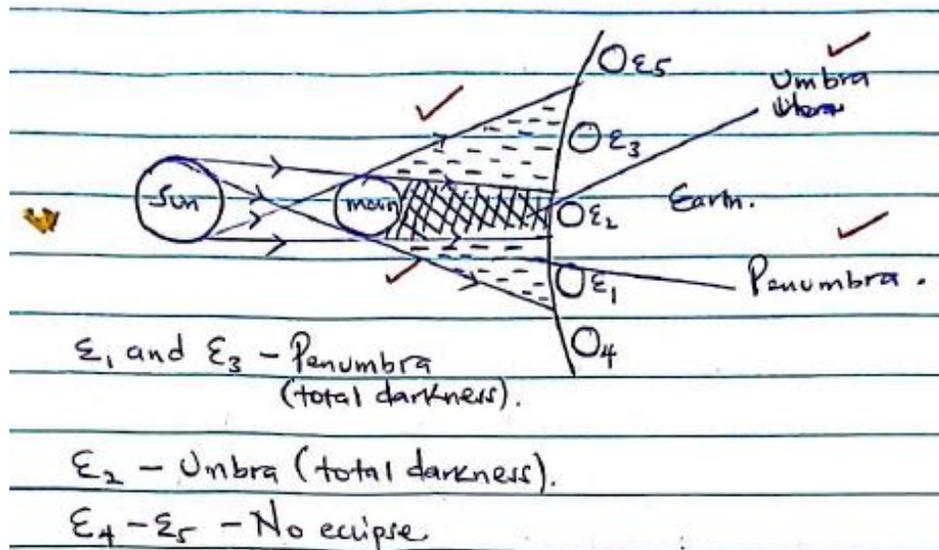The logic gate has a motion detector which when activated opens or closes the door.

Truth Table

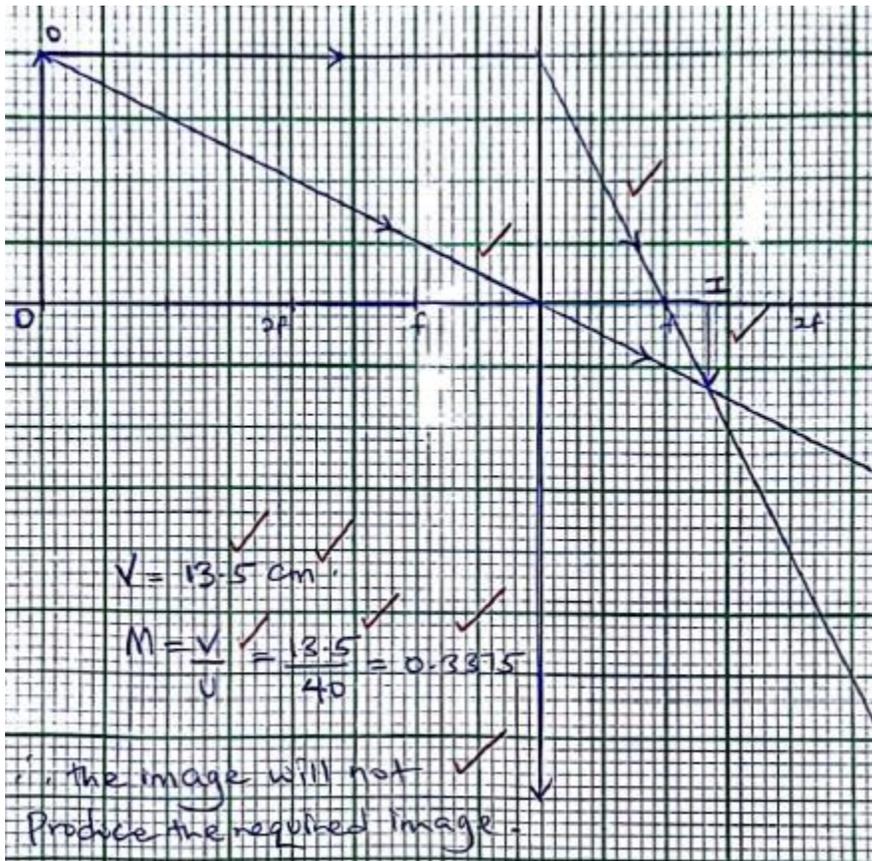| Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	1

Item five

(a) The strange phenomenon that happened was an eclipse

It was formed when light from the sun was obstructed. from reaching the earth by the moon.

ε_1 and ε_3 — Penumbra (total darkness).

ε_2 — Umbra (total darkness).

$\varepsilon_4 - \varepsilon_5$ — No eclipse.

The total darkness was because they were in the region of total darkness.

(b) The people in their headquarters did not see the darkness because they were in areas where the shadows did not reach. (E4 and E5).

On the graph, the following handwritten work appears:

$V = 13.5 \text{ cm}$

$M = \dfrac{V}{U} = \dfrac{13.5}{40} = 0.3375$

∴ the image will not produce the required image.

Item six

(a) In the morning. and at sunset, the sun is furthest from the earth. As a result, light from the sun is scattered before it reaches the earth.

Only colours like red are able to reach the earth because they have a long wavelength hence not being scattered.

At midday the sun is closest to the earth. Since blue light is scattered all over the sky making it appear blue
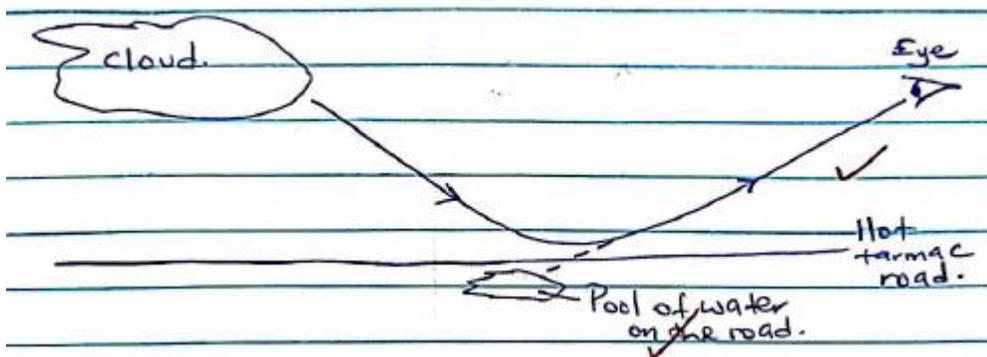
On a hot day, the temperatures are high. Due to the road being a good radiator of heat, the layers of air close the road are hotter than those far above the road making them less dense. -

As light moves from the sky, it is continuously refracted until it reaches a point where the angle of incidence is greater than the critical angle. At this point, the light is totally internally reflected making it appears like a pool of water on the road.
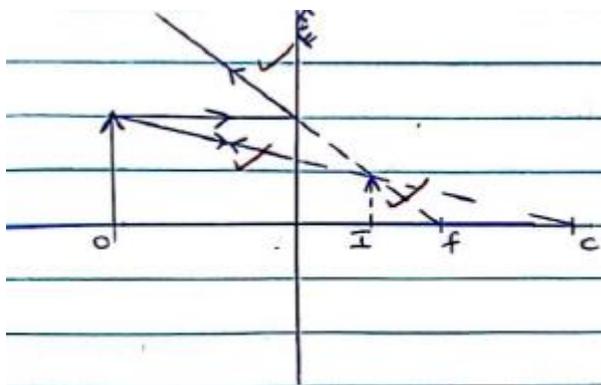
$$s = \frac{d}{t}$$

$$t = \frac{d}{s} = \frac{1}{3 \times 10^{-8}}$$

$$= 3.33 \times 10^{-9}s$$

$$t = \frac{d}{s} = \frac{1}{340}$$

$$= 2.9 \times 10^{-3}s$$

Since the waves from lightening take a shorter time to reach the earth, lightening is seen before the Sound is heard.

When an object is viewed with a convex mirror, it forms an upright, diminished, virtual image

This image formed in the minor hence being able to be seen.

Item siven

$$s = \frac{2d}{t}$$

$$t = \frac{2d}{s} = \frac{2 \times 90}{330}$$

$$= 0.55s$$

They heard than sounds because echoed were reproduced and heard since the hall was long enough.

When other speakers were put in the hall, the sound was distorted due to interference. At this point, they could hear the original sounds and the echoes from all the speakers.

The walls need to be repainted with white colour.

The white colour enables multiple reflection, creating. on impression of there being many sources of light. in the room making the room brighter.

(b) The mirror that was required was a concave minor
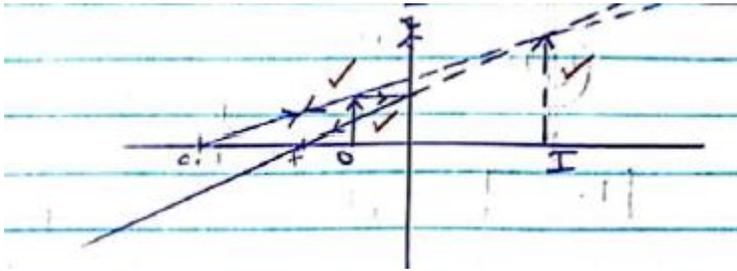
When an object is placed between the principal focus and the mirror, an upright, magnified, virtual image formed which makes the make-up artist's job is easier
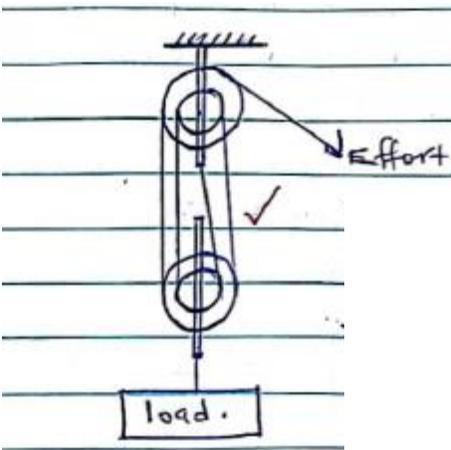
Item Eight

(a)

$$Pressure = \frac{Force}{Area}$$

$$F = mg = 70 \times 10 = 700N$$

$$Case\ 1: P = \frac{700}{40 \times 10^{-4}} = 1.75 \times 10^5 Pa$$

$$Case\ 1: P = \frac{700}{60 \times 10^{-4}} = 1.16 \times 10^5 P$$

The shoes with an area of 40 cm², exert a higher pressure on the surface sinking beneath the surface as compared to those with an area of 60 cm

(c)

The wheels are attached to load. blocks as shown. An in extensible string is passed over the wheels.

When a force is applied on the end of the string (effort), the lower block moves upwards moving the load upwards.

Its efficiency can be improved by;

✓ Reducing friction between moving parts.

✓ Using a stronger rope /string.

✓ Using a lighter string and lighter moving parts.

(d)

$$efficiency = \frac{MA}{VR} \times 100\%$$

$$100\% - 20\% = 80\%$$

$$80 = \frac{MA}{4} \times 100\%$$

$$MA = \frac{80 \times 4}{100} = 3.2$$

$$But\ MA = \frac{L}{E}$$

$$3.2 = \frac{(2 \times 80)}{E}$$

$$E = \frac{160}{3.2}$$

$$E = 50N$$

The minimum effort is 50N

Item Nine

(a) When a hot object/food is put in the fridge, it starts to loss heat to the surrounding. The volatile liquid is heated up by that heat and it evaporates.

As it does so, it loses latent heat of vaporization from the liquid. The vapor goes down to condenser where it liquefies again.

As the process continues, the food fridge gradually cools.

(b)

For water,

$$Q = m_w c_w (100 - 0)$$

$$Q = 1 \times 42,000 \times 100$$

$$Q = 420,000J$$

For ice

$$Q = m_i l_f + m_i c_w (100 - 0)$$

$$Q = 1 \times 340,000 \times 420,000$$
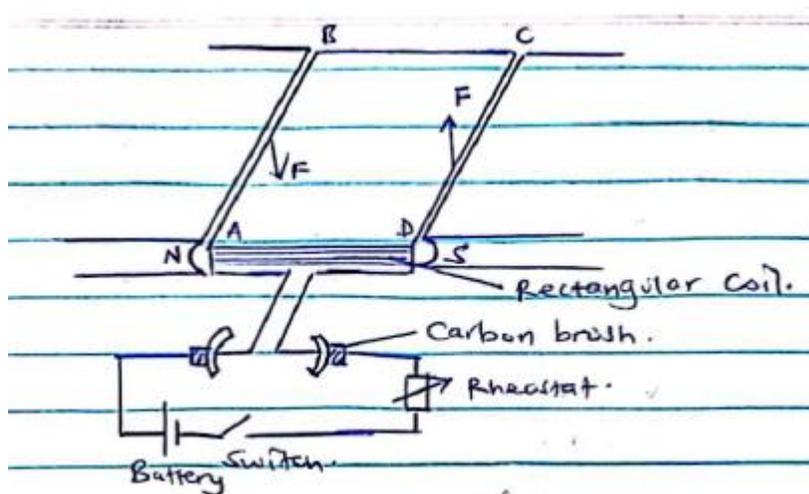
$$Q = 760,000J$$

The ice takes a longer time because it requires more heat to turn to water at 100°C.

(c) The cause of the noise is friction at the moving Parts of the wheelbarrow.

It can be reduced by;

➢ Reducing the weight on the wheelbarrow.
➢ Oiling moving parts of the wheelbarrow.
➢ Replacing the worn out parts.

Item ten

Rectangular Coil.
Carbon brush.
Rheostat.

When the Switch is closed, current flows through the Coil ABCD.

Side CD experiences an upward force while AB downward force.

The two forces form a couple which causes the Coil to rotate in an anticlockwise direction.

When the coil reaches its vertical position, the carbon brushes lose contact with the commutator cutting current off.

However, the coil continues rotating due to its inertia.

The two commutators interchange contact with the carbon brushes reversing the direction of current.

The coil continues rotating as long as current is flowing.

(b) Friction between the carbon brushes and commutators.

➢ Heating of the coils.
➢ Eddy Currents.

The efficiency of the motor can be improved by:

➢ Increasing the current flowing in the coils.
➢ Increasing the number of turns in the coils
➢ Using a stronger magnet.
➢ Winding the coil on a soft magnetic

$$From\ V = IR$$

$$40 = I \times 2$$

$$I = 20A$$

As for replacement

$$40 = I \times 4$$

$$I = 10A$$

When the coil was replaced, less current flowed through the coil reducing the efficiency of the coil.

Item eleven

The earthing protects the user of appliances in the house from electric shocks, in case the live wire touches any metallic part making it conduct electricity.

The earthing is connected to an iron bar since it provides a safe path for the stray current.

The salt and charcoal increase conductivity of the iron rod since they help in increasing moisture around the rod.

The fuse is used for safe guarding the laundry machine from excess current which would damage it. It does so my because it has a small wire with a low melting point.

When current beyond the recommended passes through that wire, it heats up and melt thus breaking the circuit.

$$P = IV$$
$$4000 = 240I$$
$$I = 16.7A$$
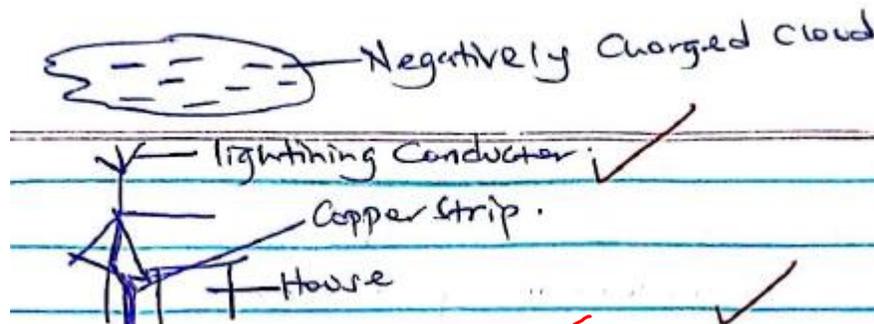
The 18A fore would be ideal for that job.

$$Cost\ of\ electricity = Cost\ per\ unit \times Number\ of\ KWh$$

$$= 800 \times \frac{4000}{1000} \times 2 \times 7$$

$$= Shs\ 44,800$$

Shs 44,800 will be required to use the laundry machine

When a negatively Charged Cloud the building, it induces positive charges on the spikes.

Due to a high charge density, the air around the spikes is ionized.

The positive ions are attracted towards the cloud while the excess negative charges are repelled towards the ground.