# O'LEVEL PHYSICS SEMINAR AT SEETA HS GREEN CAMPUS
# 24TH JUNE 2023

## MECHANICS

1. (a)(i) Define the terms; density, mass and relative density

(ii) A Cuboid of wood of mass 20g measures 5cm by 4cm by 2cm. Find its density in $kgm^{-3}$

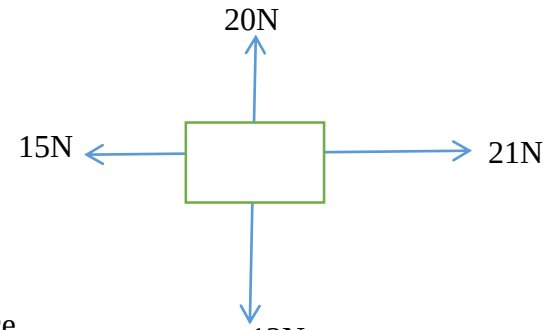
(b)(i) Define the term friction

(ii) Describe an experiment to determine the density of an irregular object

(c)(i) Distinguish between scalar and vector quantities. State two examples of each.

(ii) Four forces of 20N, 21N, 15N and 12N act on a body of mass 10kg as shown below;

(b)




Calculate the

(i) Resultant force

(ii) Acceleration of the body

2. (a)(i) Define the term linear momentum and state its S.I units

(ii) State the principle of conservation of linear momentum

(b) A 100kg car traveling at $10ms^{-1}$ collides another car of mass 1000kg travelling at $8ms^{-1}$ in the opposite direction. If the cars stick together after collision and move in the direction of a 100kg car, calculate the;

(i) Final velocity of the cars after collision

(ii) Loss in the kinetic energy

(iii) Account for the energy loss.

(c)(i) define the terms; velocity ratio, efficiency and mechanical advantage as applied to machines

(ii) Describe an experiment to the variation of mechanical advantage with load.

(iii) State two ways of improving efficiency of the machines.

3. (a)(i) Define pressure and state its SI unit

(ii) Explain briefly why high heeled shoes of ladies dig the ground.

(b)(i) State the principle of moment of force

(ii) Explain why door handles are not fixed at the extreme end of the door not near the hinges.

(ii) A uniform metal rod of length $5m$ is suspended horizontally from two supports P and Q. Support P is placed at the $0.8m$ from one end of while Q is placed at $2.0m$ from the other end. If the weight of the rod is $110N$. Calculate the reactions at 2supports P and Q

(c)(i) Distinguish between a strut and a tie

(ii) Explain why the frames of a bicycle are made hollow

(d)(i) State the Hooke's law.

(ii) Describe an experiment to verify the Hooke's law

**WAVES**

4. (a) i) What is meant by the term reverberation?

ii) A man standing midway between two cliffs claps and hears an echo after 3s.Calculate the distance between the two cliffs. (Speed of sound in air = $320ms^{-1}$)

iii) Describe an experiment to measure speed of sound in air using echo method and state any assumptions used.

(b) i) what are ultra-sonic sounds

(ii) State 2 applications of ultra sounds.

iii) Explain why sound is clearer and louder at night than during the day.

(c) A vibrator has a period of 0.02s and produces circular waves of water in a tank. If the distance between any two consecutive crests is 3cm, what is the speed of the wave?

5. (a) i) Define the terms; resonance, interference and diffraction.

ii) State the factors that affect the frequency of a stretched wire.

(b) A second harmonic of a closed pipe occurs when the length of air column is 30cm. if the speed of sound in air is $330ms^{-1}$, find the;

i) Frequency of the sound waves.

ii) Fundamental frequency

(c) Draw a diagram to show how circular incident waves are reflected from a plane reflector.

(d) Describe an experiment to that sound obeys the laws of reflection.

**MAGNETISM**

6. a) (i) What is a uniform magnetic field

(ii) Give one example of a uniform magnetic field.

b) (i) Define the term magnetic field

(ii) Draw a magnetic field in and around a solenoid connected to d.c supply

(ii) State the properties of a bar magnet

c) (i) What is a neutral point

(ii) What is magnetic shielding?

(iii) State applications of magnetic shielding

(d)(i)Describe a simple experiment to show that magnetic forces are strongest at the poles.

7. a) (i) Distinguish between Ferromagnetic and non-ferromagnetic materials. Give examples in each case

(ii) Describe the following methods of magnetizing a metal. In each, state how the polarities can be determined. Stroking method and Electrical method

(iii) With aid of a diagram, describe how consequent poles be produced by Stroking and electrical method.

b) (i) State the domain theory of magnetism

(ii) Use the domain theory to describe the process of magnetizing a metal

(iii) How can a magnet be made to lose its magnetism.

**LIGHT**

8. (a) Define power of a lens.

(b) Distinguish between a real image and a virtual image

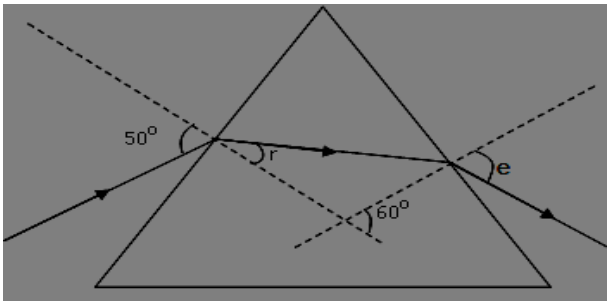
(c) A converging lens of focal length **20cm** produces an upright image of an object which is magnified 4 times. Find by scale drawing:

(i) the object distance from the lens.

(ii) nature of image.

(d) Describe how you would determine the focal length of a thin converging lens with the help of a plane mirror. Illustrate with a ray diagram.

(e) The diagram below shows a ray of yellow light incident at an angle of $\mathbf{50^0}$ on one side of an equilateral triangular glass prism of refractive index **1.52.**




Calculate the angles marked r and e .

(f) State two reasons why reflecting prisms are better reflectors than plane mirrors.

(g) Describe an experiment to determine the refractive index of the material of a glass block.

9. (a) Explain the term lateral inversion as applied to optics.

(b) Describe an experiment to show that light travels in a straight light.

(c) An object of height 4cm is placed 5cm away from a pin hole camera The screen is 7cm from the pin hole.

(i) Draw to scale a ray diagram to show the formation of the image by the pin hole

(ii) What is the nature of the image?

(iii) Find the magnification.

(iv) Explain what happens to the image if the pin hole is made larger.

(d) Draw a diagram to show the formation of a solar eclipse.

(e) (i) With the aid of a ray diagram, explain why a concave reflector is used in car head lamps.

(ii) Name two uses of a concave mirror.

10. (a) Define the following terms as applied to lenses:

(i) Optical center, (ii) Focal length

b) With the aid of a clear ray diagram show how a virtual image can be formed by

(i) a concave lens, (ii) a convex lens

(c) Describe briefly an experiment you would perform to determine the focal length of a convex lens using a plane mirror

(d) (i) An object of height 6cm is placed perpendicularly on the principal axis and 18cm from the convex lens of focal length 12cm. Find the power of the convex lens.

. (ii) State one difference between a lens camera and the human eye. (e)

(e) (i) distinguish between primary colors and complementary colors. Give two examples of each.

(ii) Explain the appearance of a student wearing a red sweater in a room with yellow light.

**MODERN PHYSICS**

11. (a) What do you understand by background radiation as applied to radioactivity?

(b) State three safety precautions to be observed when using radioactive sources.

(c) Describe briefly two uses of radioactive sources.

(d) In an experiment to find the half life of radioactive iodine, the count rate falls from 200 counts per second to 25counts per second in 75 minutes. What is its half life?

(e) Define the terms

(i) Thermionic emission (ii) Photoelectric emission

(f) Draw a diagram of a thermionic diode and label its parts .Explain how it works.

(g ) (i) Explain why an X-ray tube is evacuated.

(ii) What do you understand by hard and soft X –rays.

(ii) Give two applications of x-rays.

12. (a) (i) What are cathode rays?

(ii) State two differences between gamma rays and cathode rays (02marks)

(b) Describe a simple experiment to distinguish the three radiations that are emitted by radioactive materials.

(c) A radioactive element has a half life of 4 minutes. Give that the original count rate is 256 counts per minute,

(i) Find the time taken to reach a count rate of 16 counts per minute.

(ii) What fraction of the original number of atoms will be left by the time the count rate is 16 counts per minute?

(d) (i) what is meant by isotope?

(ii) Which of the following nuclei belong to the same element?

$${}^{24}_{11}X, {}^{24}_{12}Y, {}^{25}_{11}Z$$

(iii) Explain why isotopes cannot be separated by chemical processes

**ELECTRICITY AND ELECTROSTATICS**

13. (a) Draw a diagram to show the structure of a simple cell.

(b) Give two advantages of an alkaline cell over a lead acid cell.

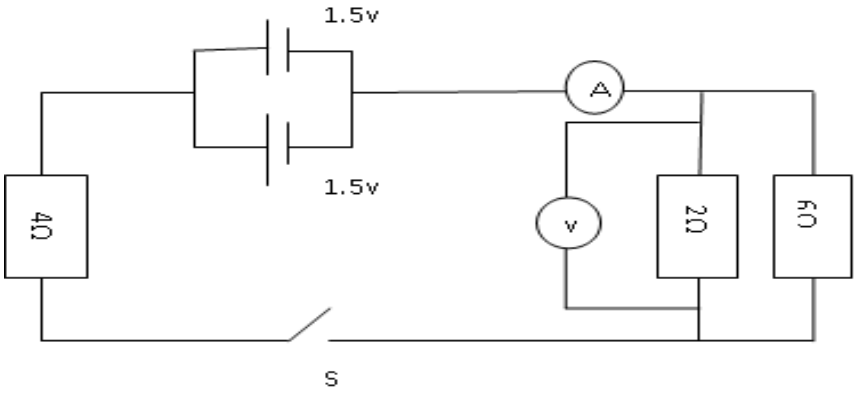
(c) Briefly explain how an accumulator can be recharged.

(d) State one advantage lead acid cells have over alkaline cells.

(e) (i) Define internal resistance and electromotive force of a cell.

(ii) Describe an experiment to determine the internal resistance and the electromotive force of a cell.

(f) The figure below shows two cells , each of internal resistance 1Ω connected to a circuit which includes a 6Ω,2Ω and 4Ω resistor.




What is the reading of the ammeter and voltmeter when switch S is closed?

15. (a) Distinguish between a conductor and an insulator. Give an example each.

(b) (i) Explain briefly how you can charge a conductor negatively by induction.

(ii) Describe how it can be confirmed that the conductor is negatively charged.

(c) (i) Explain the action and mode of operation of a lightening conductor.

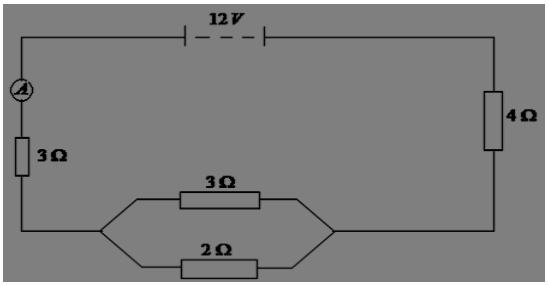
(ii) Distinguish between a primary cell and a secondary cell.

(d) Mention four ways of caring and maintaining a secondary cell.

(e) (i) Draw a well labeled diagram of a dry (Leclanch'e) cell.

(ii) How is polarization overcome in a dry cell?

(d) Four resistors are connected across a 12V battery, of negligible internal resistance as shown in the figure below




(i) Determine the reading of the ammeter A.

(ii) The p.d across the parallel combination of resistors.

(e) Name one instrument that turns chemical energy to electrical energy.

**HEAT**

16. (a) Define,

(i) Temperature (ii) Specific heat of capacity.

(b) Describe an experiment to determine the specific heat capacity of a solid by method of mixtures.

(c) (i) What is meant by latent heat of evaporation

(ii) The cooling system of a refrigerator extracts0.7kW of heat. How long will it take to convert $500g$of water at $20^{o}C$ into ice at 0°C

(d) An electrical kettle rated at 2.25kW takes2.5min to raise the temperature of 0.80kg of water by $80^{0}$C. Calculate:

(i) The heat produced by the kettle in this time.

(ii) Heat absorbed by water

(iii) Suggest one reason for the difference in these readings

(e) (i) Explain why water in a lake feels much cooler during daytime than at night.

(ii) Explain why a burn from steam is more harmful than a burn caused by boiling water.

(iii) Equal volumes of water at the same temperature are poured in a cup and on a plate. With a brief reason, state which water will evaporate faster.

(f) (i) State Charles, law?

(ii) A volume of 2500cm$^3$ of hydrogen gas is collected at 67$^o$C at a pressure of 730mmHg. Calculate the volume of the gas at s.t.p.

(g) An un graduated thermometer has its ice and steam points separated by a distance of 70cm. if on measuring the bulb in a solution, the mercury thread raises to 2cm below the ice point, find the temperature it reads in $^0$C.

## ORDINARY LEVEL PHYSICS PRACTICAL 535/3 and 535/4 SEMINAR

**Requirements for the seminar**

- Calculator.
- Pen (no pencil).
- Graph paper.
- 30 cm long transparent ruler.
- Complete mathematical set.

**1. Table 1**

$T_1 = 2.00$ s

$T_1^2 =$ _____

In the table below $t$ is time for twenty oscillations.

| $l(\,cm)$ | $t(\,s)$ |
|---|---|
| 80.0 | 36.0 |
| 70.0 | 33.0 |
| 60.0 | 31.5 |
| 50.0 | 29.0 |
| 40.0 | 26.0 |
| 30.0 | 22.5 |

(a) Copy the table and include values of $T_2$ (time for one oscillation), $T_2^2$ and $T^2 = T_1^2 - T_2^2$.

(b) Plot a graph of $T^2$ (**along the vertical axis**) against $\boldsymbol{l}$ (**along the horizontal axis**).

(c) Calculate the slope, $S$, of the graph.

(d) Read and record the intercepts $C_1$ on $T^2$-axis and $C_2$ on the $l$-axis.

**2. Table 2**

| $\alpha(°)$ | $\theta(°)$ | $x(cm)$ |
|---|---|---|
| 10 | 7 | 0.8 |
| 20 | 13 | 1.5 |
| 30 | 20 | 2.3 |
| 40 | 26 | 3.2 |
| 50 | 31 | 3.9 |
| 60 | 34 | 4.4 |

(a) Copy the table and include the values of $\sin\alpha$ and $x\cos\theta$.

(b) Plot a graph of $\sin\alpha$ (**along the vertical axis**) against $x\cos\theta$ (**along the horizontal axis**).

(c) Find the slope, $S$, of your graph.

(d) Determine the intercept, $C$, on the $x\cos\theta$-axis.

(e) Calculate, $n$, from the expression:

$n = ySC$ where $y = 6.25 \times 10^1$

**3. Table 3** $E = 1.5\,V$

| $l$(m) | $V$(V) | $I$(A) |
|---|---|---|
| 0.100 | 0.95 | 0.46 |
| 0.200 | 0.80 | 0.40 |
| 0.300 | 0.65 | 0.34 |
| 0.400 | 0.60 | 0.30 |
| 0.500 | 0.50 | 0.26 |
| 0.600 | 0.35 | 0.22 |

(a) Copy the table and include values of $(E - V)$ and $\frac{(E-V)}{I}$.

(b) Plot a graph of $\frac{(E-V)}{I}$ (**along the vertical axis**) against $l$ (**along the horizontal axis**).

(c) Find the slope $\beta$ of the graph.