TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY

LEVEL 6 YEAR 1 EXAMINATION

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: JULY AUGUST 2025

SUBJECT: FOUNDATION PHYSICS THEORY

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your Examination Number and National Registration Card (NRC) Number on the answer booklet provided.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip.
3. This paper has seven (7) questions. Question one (1) is compulsory. Answer four (4) Questions from the remaining six (6) Questions.
4. Diagrams may be used where necessary to clarify your answer.
5. Cell phones and programmable calculators are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

QUESTION ONE (COMPULSORY)

a) State **two (2)** examples of:
   (i) Dimensional constant **[2 marks]**
   (ii) Dimensionless constant **[2 marks]**

b) Express the following quantities in base units:
   (i) Pressure **[3 marks]**
   (ii) Force **[3 marks]**
   (iii) Energy **[3 marks]**

c) Convert the following to the stated units:
   (i) A speed of 40kmh^{-1} to cms^{-1}.. **[2 marks]**
   (ii) Density of 50kgm^{-3} to milligrams per cubic decimetre. **[3 marks]**
   (iii) A volume of 3 litres to cubic decimetres. **[2 marks]**

[Total: 20 marks]

QUESTION TWO

a) Write down the dimensions of the following:
   (i) Velocity **[2 marks]**
   (ii) Acceleration **[2 marks]**
   (iii) Force **[2 marks]**
   (iv) Power **[2 marks]**

b) A ball of mass m is thrown vertically upwards with an initial velocity U. It experiences a force F= λV^2 when it had attained a speed V due to air resistance where λ is a constant
   (i) Determine the dimensions of λ **[2 marks]**
   (ii) A formula approximating the highest height H reached by the ball is

$$H \approx \frac{U}{2g} - \frac{\lambda V^4}{4mg^2}$$ where g is the acceleration due to gravity.

   Show that the formula is dimensionally consistent. **[4 marks]**

c) A moving car experiences a force F due to air resistance. It is known that F depends on a product of powers of its velocity V, its cross sectional area A and the density ρ and is governed by $F=\frac{1}{2} C \rho^{\alpha} V^{\beta} A^{\gamma}$. Use dimensional analysis to find values of α, β and γ.

[6 marks]

[Total: 20 marks]

QUESTION THREE

a) Sketch the diagram of a convex lens to show the meaning of Optic centre, Principal Focus, Focal length and Principal axis. [8 marks]

b) Draw a well labelled Ray diagram to illustrate the formation of an image when a 5 cm object is placed between the optical centre and the principal focus. **[8 marks]**

c) State **four (4)** uses of a Convex in everyday life. **[4 marks]**

[Total: 20 marks]

QUESTION FOUR

a) State **three (3)** applications of the moment of a force. **[6 marks]**

b) Figure 3.0 shows a flagpole of mass 12. 5 kg and the flag piece of 125g mass at the end. The flagpole is kept in equilibrium by means of a cable attached to the wall.

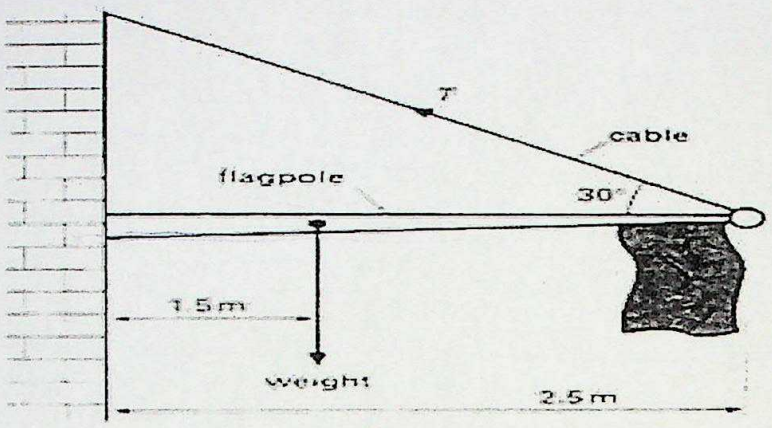


Fig. 3.0

(i) Determine the magnitude of the tension force T in the cable needed to keep the system in static equilibrium. **[6 marks]**

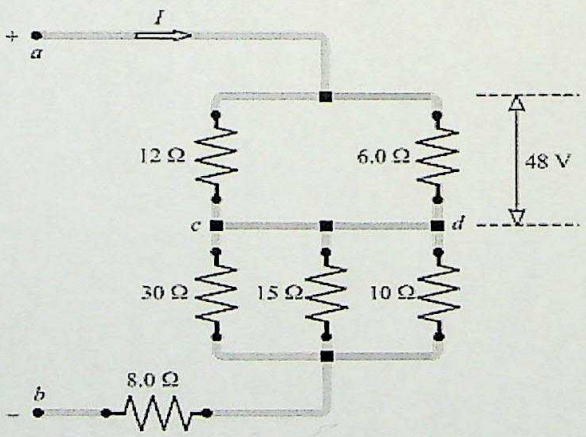
(ii) Calculate the magnitude and direction of the resultant force on the beam. **[8 marks]**

[Total: 20 marks]

QUESTION FIVE

a) Explain reasons for using AC and not DC in transformers **[2 marks]**

b) The diagram below shows a circuit.



Calculate:

(i) Current (*I*) **[5 marks]**

(ii) Voltage across the 8Ω and 10Ω resistors **[8 marks]**

(iii) Voltage across the terminals ***a*** and ***b*** **[5 marks]**

[Total: 20 marks]

QUESTION SIX

a) Define the following for thermometers:
   (i) Lower fixed point **[2 marks]**
   (ii) Upper fixed point **[2 marks]**

b) State the practical application for each of the following:
   (i) Linear expansion **[1 mark]**
   (ii) Superficial expansion **[1 mark]**

c) A faulty thermometer reads -2°C when in pure melting ice and a certain 103°C When in steam from boiling at normal atmospheric temperature and pressure. The thermometer records a certain temperature as 61°C.
   (i) Determine the true centigrade temperature. **[4 marks]**
   (ii) At what temperature does this thermometer give a true reading? **[4 marks]**

d) Calculate the minimum amount of ice at -10°C that must be added to 0.50kg of water at 20°**C** in order to bring the temperature of the mixture down to 0°C. Given that:
   Specific heat capacity or water = 4.186J/kg°C
   Latent heat of ice =334kJ
   Specific heat capacity of ice =2090J/kg°C **[6 marks]**

[Total: 20 marks]

QUESTION SEVEN

a) Explain the following terms:
   (i) Alpha decay **[2 marks]**
   (ii) Beta decay **[2 marks]**
   (iii) Gamma decay **[2 marks]**
   (iv) Transmutation **[2 marks]**

b) With reference to Geiger Muller counter, explain how you would show that a sample emits Alpha, Beta and Gamma radiations. **[8 marks]**

c) A radioactive material is found to have a mass of 400mg. Determine the half -life of this sample, given that 25 mg of this sample is found after 30 days. **[4 marks]**

[Total: 20 marks]