

Physics I

011

01/11/2013 08.30am – 11.30am



RWANDA EDUCATION BOARD

ORDINARY LEVEL NATIONAL EXAMINATIONS 2013

SUBJECT : PHYSICS I

DURATION : 3 HOURS

INSTRUCTIONS:

1. Do not open this paper until you are told to do so.

2. This paper has **THREE** sections A, B and C:

SECTION A : This section is **compulsory** (55 marks)

SECTION B : Attempt **any three** questions. (30 marks)

SECTION C : Attempt **Only one** question. (15 marks)

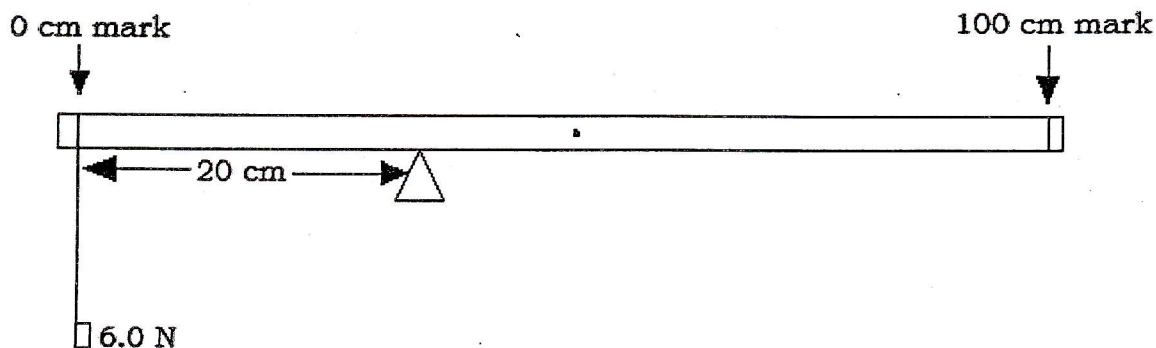
3. Calculators may be used.

4. Use only a blue pen and pencil.

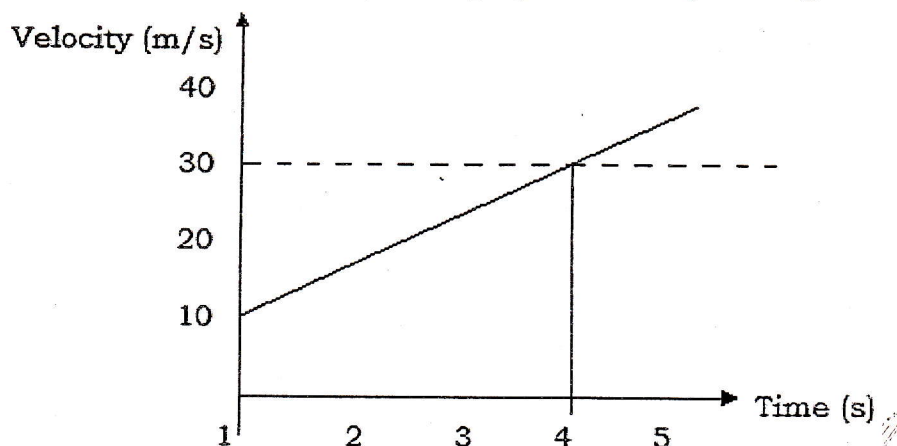
SECTION A : ATTEMPT ALL QUESTIONS

(55 marks)

1. a) What is the instrument used to measure the density of milk called? (1 mark)
- b) The density of salt is 2.16 g/cm^3 . What is the volume of 216g of salt? (2 marks)
2. The diagram below shows a uniform metre rule balanced horizontally when a force of 6.0 N is hang at the 0 cm mark. Calculate the weight of the metre rule. (3 marks)

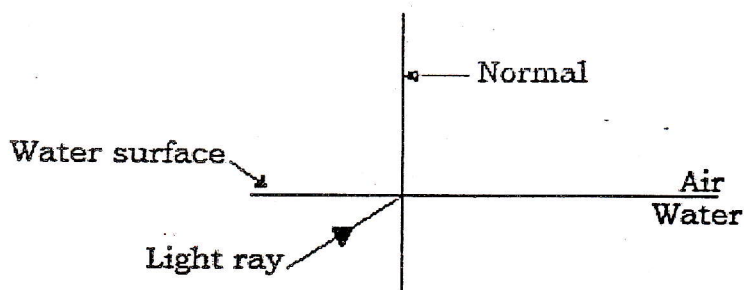


3. The figure below shows a velocity-time graph for a body moving



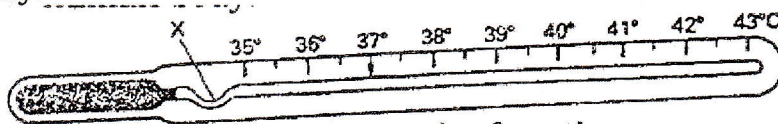
From the above graph:

- a) What is the initial velocity? (1 mark)
- b) What is the distance moved in 5 seconds? (2 marks)
4. The mass of a rectangular block of dimensions $5\text{m} \times 1\text{m} \times 2\text{m}$ is 50 kg. What is the minimum pressure that it can exert? Given that 1 kg exerts a force of 10 N. (3 marks)
5. a) Copy the diagram below and complete it to show the path of the ray of light travelling from water to air. Angle of incidence is greater than critical angle. (2 marks)



- b) Why does the ray of light take the path you have shown? (1 mark)
6. a) What is a neutral point in a magnetic field? (2 marks)
- b) State any two methods of making a magnet in a laboratory. (2 marks)

7. a) What is meant by specific latent heat of vaporization? (1 mark)
 b) State two factors which affect the boiling point of water. (2 marks)
 c) What is the heat needed to change 0.8 kg of water at 100°C to steam?
 Specific latent heat of vaporization of water = 2.26×10^6 J/kg. (2 marks)
8. a) What is the difference between energy and power? (2 marks)
 b) What is the power of a water pump which can lift 100 kg of water through a vertical height of 5m in 10s. Take $g = 10\text{m/s}^2$. (2 marks)
 c) A ball is held 2m above the ground and then released. List the energy changes which occur. (1 mark)
9. a) State two electrical charges. (2 marks)
 b) A positively charged rod AB is suspended horizontally at its midpoint. One end of a positively charged rod is brought just below end A. State what happens to end A of the rod AB. (1 mark)
10. Three cells are arranged in a parallel and connected to a 2 ohms resistor.
 a) Draw a simple electric circuit to represent this arrangement. (2 marks)
 b) If each cell has a potential of 1.5V, calculate the current in the circuit. (2 marks)
 c) If one cell is removed from the circuit, is there any change in the current in the circuit? (1 mark)
11. a) Name two types of curved mirrors. (2 marks)
 b) State two uses of a convex mirror. (2 marks)
12. A measuring cylinder is filled with a liquid.
 a) What does the pressure of the liquid at the bottom depend on? (2 marks)
 b) If the depth of the liquid is 0.3m and the pressure it exerts at the bottom is 3000 Pa, find the density of the liquid. $g = 10\text{m/s}^2$. (2marks)
13. Give an example to justify that air of the atmosphere exerts force. (2 marks)
14. The diagram below shows a thermometer used to measure the temperature of a human body.

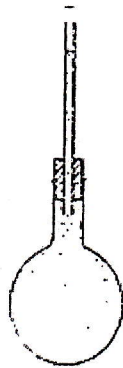


- a) Name part X and state its function. (2 marks)
 b) What happens when you place this thermometer under the tongue of a patient? (1 mark)
 c) Why is the temperature range between 35°C - 43°C? (1 mark)

SECTION B: ATTEMPT ANY THREE QUESTIONS.

(30 marks)

15. a) Name any two physical properties of matter which change with change of temperature. (2 marks)
 b) Convert a temperature of 300 K to Celsius degrees, °C. (2marks)
 c) Explain what is meant by the term "unusual expansion of water". (3 marks)
 d) Liquids expand when heated. The diagram below shows a flask full of water with fitted glass tube.



- i) What happens when the flask is heated? (1 mark)
- ii) What happens when you continue heating the water? (1 mark)
- e) What effect does increase in pressure have on the melting point of ice? (1 mark)
16. a) What are pulleys? (2 marks)
- b) State two reasons why the efficiency of pulleys is always less than 100%. (2 marks)
- c) A pulley raises a load of sand of weight 300N using an effort of 60N. What is the mechanical advantage of the system? (2 marks)
- d) Efficiency of a machine is 80% and the mechanical advantage is 4. Find the velocity ratio. (2 marks)
- e) A pulley raises a load 4cm when an effort used moves 12cm. What is the velocity ratio. (2 marks)
17. a) What is a lens? (2 marks)
- b) State the properties of images formed in a converging lens when the object is nearer the lens than the focal point. (3 marks)
- c) Give any two applications of a converging lens. (2 marks)
- d) What are the characteristics of images in a diverging lens? (3 marks)
18. a) State Ohm's Law. (2 marks)
- b) What voltage is needed to drive a current of 2.5A through a resistance of 2? (2 marks)
- c) A voltmeter is connected in parallel in an electric circuit and an ammeter is connected in series in a circuit. Why? (4 marks)
- d) i) What does the symbol below represent in an electric circuit? (1 mark)
-
- ii) State the function of the symbol in d (i) (1 mark)
19. a) Dry wood of weight 20N floats on water. What is the weight of the liquid displaced by the wood? (2 marks)
- b) State Archimedes' principle. (2 marks)
- c) A body weighs 24N in air and when wholly immersed in water it weighs 12N. What is the relative density of the body? (2 marks)
- d) A ship is made of iron and some other materials but it does not sink into water. Why? (3 marks)
- e) A balloon filled with some amount of a light gas when released, rises into air. At some point it stops rising and drifts sideways. Explain why the balloon rises and then stops rising. (2 marks)

SECTION: ANSWER ONE QUESTION ONLY**(15 marks)**

20. a) List eight basic laboratory rules which ensure safety of students and the materials in the laboratory. **(8 marks)**
- b) List any seven careers in which Physics is necessary. **(7 marks)**
21. List five important ways in which science is useful in each of the cases below:
- a) Industries. **(5 marks)**
- b) Work places. **(5 marks)**
- c) Our lives. **(5 marks)**

END**ANSWERS TO ORDINARY LEVEL PHYSICS PAPER 2013****SECTION A:**

1a) Lactometer

b) density = 2.16g/cm^3 , mass = 216g

$$\text{Volume} = \frac{\text{mass}}{\text{density}} = \frac{216}{2.16} = 100\text{cm}^3$$

2. Clockwise moment = anticlockwise moment

$$\left(\frac{30}{100}\right) \times w = 6 \times \left(\frac{20}{100}\right) \Rightarrow 0.3w = 6 \times 0.2 \Rightarrow w = 4\text{N}$$

The weight of the meter rule is 4N.

3. a) Initial velocity is 10m/s.

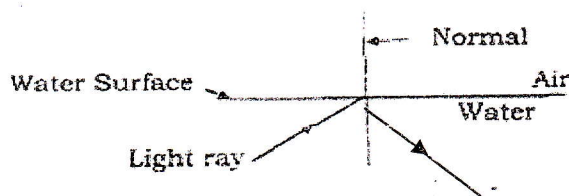
b) Distance moved = Area under the curve (it's a trapezium)

$$= \frac{1}{2} h(a + b) \Rightarrow \frac{1}{2} \times 5(10 + 35) \Rightarrow \frac{5(45)}{2} = \frac{225}{2} = 112.5\text{m}$$

 \therefore Distance covered is 112.5m4. Area₁ = $5 \times 1 = 5\text{m}^2$ Area₂ = $5 \times 2 = 10\text{m}^2$ Area₃ = $1 \times 2 = 2\text{m}^2$

$$\text{Minimum pressure} = \frac{\text{Force}}{\text{Maximum area}} = \frac{50 \times 10}{10} = 50\text{N/m}^2$$

5 a)



- b) Because it has been totally reflected within the water or it has undergone total internal reflection.
6. a) A neutral point is a point in a magnetic field where magnetic force is not experienced or it's a point in a magnetic field where the resultant field force is zero.
- b) Electrical method, induction method, single touch method/stroking method, double touch/shocking method.
7. a) Specific latent heat of vaporization is the quantity of heat required to change a liquid to a gas (or vapor) without change in temperature.

- b) - Pressure: increase in pressure increases the boiling point.
 - Impurities: Addition of impurities increases the boiling point.

c) $m = 0.8\text{kg}$

$$q = mLv = 0.8 \times 10^6 \text{ J}$$

$$\therefore q = 180800 \text{ J or } 1.808 \times 10^6 \text{ J}$$

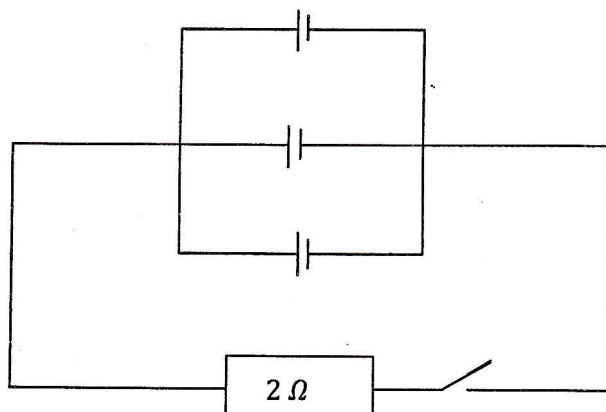
8. a) Energy is the ability of a body to do work while power is the rate at which work is done.
 Energy is measured in joules while power is measured in Watts (or joules per second)

b) $\text{Power} = \frac{F \times d}{t} = \frac{100 \times 10 \times 5}{10} = 500\text{W}$

c) Potential energy \longrightarrow Kinetic energy \longrightarrow Sound energy \longrightarrow Heat energy.

9. a) Negative charges (-) (electrons)
 Positive charges (+) (Protons)
 b) End A will be repelled upwards.

10. a)



b) Total p.d = 1.5V

$$\text{From the equation } V = IR ; I = \frac{V}{R} = \frac{1.5}{2} = 0.75\text{A}$$

\therefore Current in the circuit = 0.75A.

- c) No there is no change in the current, when cells are arranged in parallel, their total voltage is equal to the voltage or e.m.f of one cell.

11. a) Convex mirrors, concave mirrors
 b) used as car driving mirrors, used as a security mirror in places like supermarkets.

12. a) - it depends on the density of the liquid
 - it depends on the depth of the liquid from the surface to the bottom.

b) $h = 0.3$, pressure = 3000Pa, $g = 10\text{m/s}^2$

$$p = h \rho g.$$

$$3000 = 0.3 \rho \times 10 \Rightarrow \rho = \frac{3000}{3} = 1000\text{kg/m}^3$$

13. When a gas is filled with water and its mouth is covered with a plane paper and it is inverted, the water does not pour out of the glass. (OR you can use the crushing can experiment, drinking staw, siphon, syringe)

14. a) Part X is called the constriction
It is used to prevent the mercury from flowing back to the bulb after the thermometer has been removed from the patient's body so as to enable the doctor take the reading at his/her convenient time.
- b) The liquid inside the bulb expands and rises through the constriction.
- c) It is the range for the normal human body temperature.

SECTION B

15. a) Length, cross-sectional area, volume, resistance, pressure
- b) $300\text{K} = (300-273)^{\circ}\text{C} = 27^{\circ}\text{C}$.
- c) Unusual expansion of water is the behavior of water in which it contracts when heated from a temperature of 0°C to a temperature of 4°C and expands when cooled from a temperature of 4°C to 0°C . This is not the same case with the other liquids.
- d) i) When the flask is heated, it expands and the liquid inside the glass falls abit.
ii) The liquid in pressure lowers the melting point of ice.
16. a) Pulleys are wheels with grooved rims around which ropes can run.
- b) - Some energy is wasted to overcome friction between the moving parts.
- Some energy is wasted to lift the pulleys themselves.
- c) Mechanical advantage = $\frac{\text{Load}}{\text{Effort}} = \frac{300}{60} = 5$.
- d) $\frac{\text{M.A}}{\text{V.R}} \times 100\% = \text{Efficiency}$
- $$\frac{4}{\text{VR}} \times 100 = 80 \Rightarrow \frac{400}{\text{VR}} = 80 \Rightarrow \text{VR} = 5.$$
- e) Velocity ratio = $\frac{\text{distance moved by effort}}{\text{distnace moved by load}} = \frac{12}{4} = 3$.
17. a) A lens is an optical instrument normally made out of glass with two spherical reflecting surfaces.
- b) - The image is virtual, It is upright (or erect), It is magnified.
- c) - It is used in cameras, projectors, telescopes
- It is used in microscopes.
- It is used in spectacles that are used by people with long sight.
- d) Virtual, Upright (or erect), Diminished
18. a) If temperature and other physical quantities are kept constant, the potential difference in a circuit is directly proportional to the current. $V \propto I$, $V = IR$
- b) $V = IR$
 $V = 2.5 \times 2$
 $V = 5V$.
- c) Since the voltmeter measures potential difference which requires both positive and negative terminals, it must be connected in parallel to be able to tap from both terminals while an ammeter measures current which flows in one direction.
- d) i) The symbol represents a potential divider.
ii) - To change the potential difference across the device.
- Give the output voltage so as a fraction of the input voltage

19. a) Weight of liquid displaced by = 20N.
b) When a body is partially or fully immersed in a fluid, it experiences an apparent loss in weight which is equal to the weight of fluid displaced.
c) $W_a = 24\text{N}$, $W_w = 12\text{N}$.

$$\text{Upthrust} = W_a - W_w = 24 - 12 = 12\text{N}$$

$$\text{Relative density} = \frac{W_a}{\text{Upthrust}} = \frac{24}{12} = 2.$$

- d) A ship is made hollow and with a wide bottom, something that lowers its density than that of water.
e) The up thrust on it is greater than its weight so the resultant upward force causes it to rise. At some point the balloon stops rising because the up thrust becomes equal to the total weight of the balloon.

SECTION C

20. a) Laboratory rules that ensure safety:

- Do not run or play in the lab
- Never eat or drink in the lab
- Never enter the laboratory without a teacher or laboratory technician
- Do not look into the mouth of a test tube or flask while you are heating or adding reagents.
- Do not sniff materials in the laboratory as they may be toxic
- Never eat seeds or parts of plants that may be provided for biological studies
- Never carry out any experiments without the instructions of a teacher or technician
- Always wash your hands before leaving the laboratory.
- Obey all the safety rules at all times.

- b) Careers in Physics

- Civil Engineering
- Mechanical Engineering
- Electrical Engineering
- Teaching
- Medicine (or being a doctor)
- Pilot
- Industrial engineering
- Computer and electronics engineering
- Agricultural Engineering

21. Ways in which science is useful in:

a) *Industries.*

- Food processing, quality control, monitoring the sizes of different products produced, raising heavy loads, designing and branding of new products, measuring different quantities, electrical installation and fitting, security systems, manufacturing of products, construction etc.

b) *Work places*

- Computer usage, alarm systems, telecommunication gadgets, used in elevators, cooking, security systems, transport etc.

c) *Our lives*

- Medicine, nutrition and diet, farming, transport, birth control methods, cooking, security systems.

END