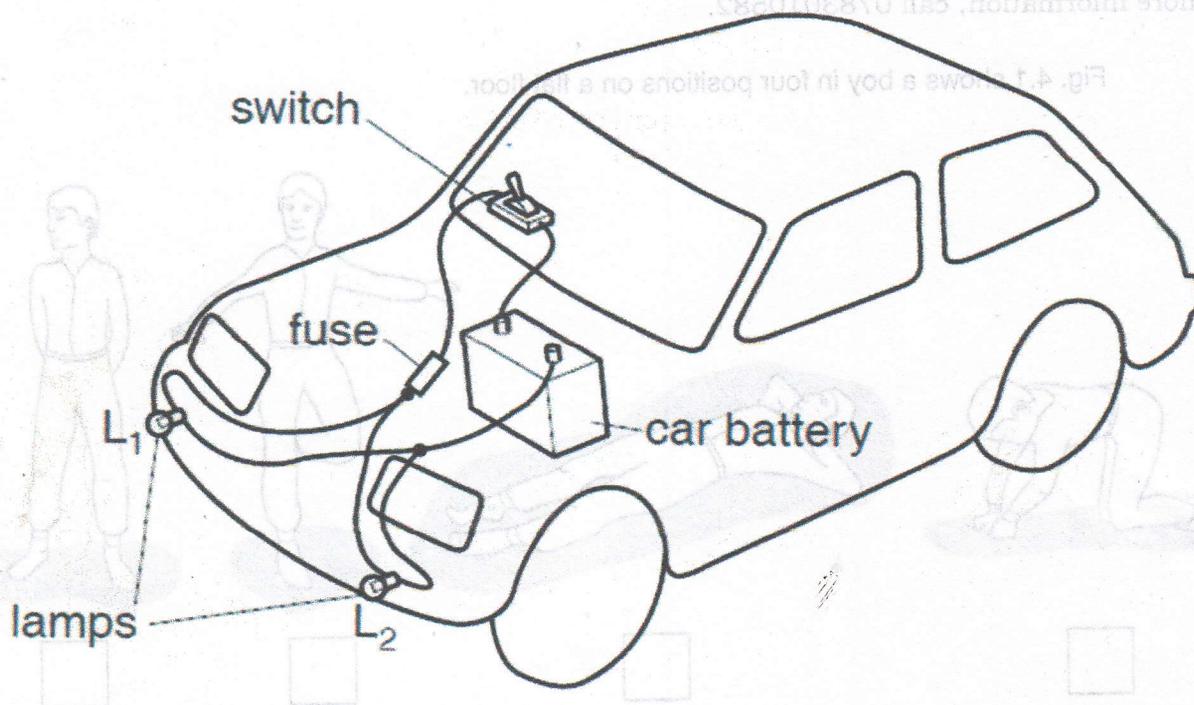


O-LEVEL PHYSICS PASSWORD

FROM THE YEAR 2000 TO 2015

O-LEVEL REB PAST PAPERS WITH ANSWERS

THE FIGURE REPRESENTS THE CIRCUIT THAT OPERATES TWO OF THE LAMPS
ON A CAR



Draw the circuit diagram for this circuit using conventional symbols.

Education

"Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, that a son of a mineworker can become the head of the mine, that a child of a farm worker can become the president of a nation."—Nelson Mandela

This REB past paper question and answer booklet has been compiled to enable the Rwandan child who is so much interested in Physics to practice constantly, after all practice makes perfect.

Other O - level books containing past paper questions with answers include Physics, Chemistry, Biology and Geography.

ON A CAR

For more information, call 0783010582.

Fig. 4.1 shows a boy in four positions on a flat floor.

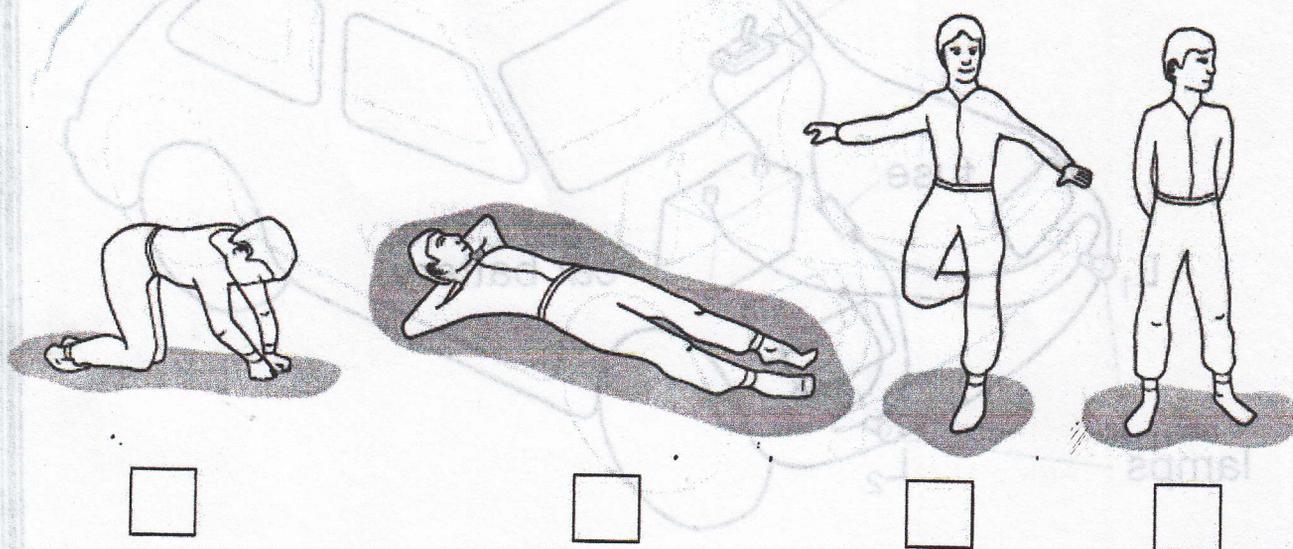


Fig. 4.1

- (i) Put a tick in the box under the position where the boy is exerting the **least** pressure on the floor.

Physics I

011

13/11/2015

08.30AM – 11.30AM



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2015

SUBJECT: PHYSICS I

DURATION : 3 HOURS

INSTRUCTIONS:

- 1) Write your names and index number on the answer booklet as they appear on your registration form and **DO NOT** write your names and index number on additional answer sheets of paper if provided.
- 2) Do not open this question paper until you are told to do so.
- 3) This paper has **THREE** sections **A, B** and **C**.

SECTION A: Attempt **ALL** question.

(55 marks)

SECTION B: Attempt any **THREE** questions

(30 marks)

SECTION C: Attempt **ONLY ONE** question.

(15 marks)

- 4) Calculators and mathematical instruments may be used.
- 5) Use **only a blue or black pen and pencil**.
- 6) Calculators and mathematical instruments may be used.

SECTION A: ATTEMPT ALL QUESTIONS. (55 MARKS)

- 1) A piece of steel has a volume of 12cm^3 and a mass of 96g. Find the density of the steel. Express the answer in kg/m^3 . (3 marks)
- 2) What is the difference between "distance" and "displacement"? (3 marks)
- 3) (a) What is meant by the term "acceleration of a moving body"? (1 mark)
(b) The velocity of a car slows down uniformly from 98km/h to 48km/h in 10 seconds. Calculate the deceleration on the car. (2 marks)
- 4) Explain why standing passengers in a fast moving bus continue to move forward when the bus stops suddenly. (3 marks)
- 5) (a) Which quantity has the same unit as energy? (1 mark)
(b) An engine force of 5000N pulls a car 100m . Find the work done by the engine. (2 marks)
- 6) (a) What is meant by "mechanical advantage" of a machine? (1 mark)
(b) What does the mechanical advantage of a machine depend on? (1 mark)
(c) Write the equation relating mechanical advantage, velocity ratio and efficiency of a machine. (1 mark)
(d) What are pulleys used for? (1 mark)
- 7) (a) Why is it painful to carry a heavy parcel by a thin string? (2 marks)
(b) A block of metal produces an average pressure of 1000N/m^2 when resting on a flat surface of area 0.5m^2 . Find the force exerted by the block. (2 marks)
- 8) (a) Define the term "specific latent heat" of a substance. (2 marks)
(b) 17600J is given up when 8g of steam at 100°C condenses to 8g of water at 0°C . Find the specific latent heat. (2 marks)
- 9) (a) Give an example of a self luminous object. (1 mark)
(b) Define the term a "light ray". (1 mark)
(c) A beam of light rays may be parallel, diverging or converging. Which type of beam of rays is produced by headlamps of a car at night? (1 mark)
(d) State any one property of light. (1 mark)
- 10) (a) State the laws of reflection of light at a plane surface. (2 marks)
(b) What is a simple periscope made of? (1 mark)
(c) What is the use of a simple periscope? (1 mark)
- 11) (a) Why are plastic materials used to cover copper wires carrying electricity? (2 marks)
(b) The current I passing a section of a wire is 4 coulombs per second. Calculate the quantity of charge passing the section of the wire. (2 marks)
- 12) (a) Define the following terms:
(i) Potential energy. (1 mark)
(ii) Kinetic energy. (1 mark)
- (b) A car of mass 1000kg runs at a speed of 20m/s . calculate the kinetic energy of the car. (2 marks)

- 13) (a) What is the disadvantage of primary cells? (1 mark)
 (b) What is the advantage of secondary cells? (1 mark)
 (c) Where are secondary cells used? (2 marks)
- 14) (a) State any two methods of making magnets. (2 marks)
 (b) How can a magnet be demagnetized? (2 marks)
- 15) (a) What is a magnetic field? (1 mark)
 (b) Why are magnetic fields vectors? (2 marks)
 (c) Between two like poles of a bar magnet there is a point called neutral point. What is this neutral point? (1 mark)

SECTION B: ATTEMPT THREE QUESTIONS ONLY. (30 MARKS)

- 16) (a) State laws of refraction of light? (2 marks)
 (b) Why does a ray of light travelling from air through a glass block bend towards the normal at the point where it enters the glass block? (2 marks)
 (c) When white light passes through a triangular glass prism, it is refracted and different colors are produced.
 (i) Why is the white light split into many colors? (1 mark)
 (ii) Which color is refracted most? (1 mark)
 (iii) Which color is refracted least? (1 mark)
 (iv) Name the colors in order starting with the least refracted to the most refracted. (1 mark)
 (d) Which lens causes a beam of white light parallel to the principal axis:
 (i) to converge to a real focus? (1 mark)
 (ii) to diverge from a virtual focus? (1 mark)
- 17) (a) What is meant by the term "center of gravity of a body"? (2 marks)
 (b) Mention the equilibrium states of a body. (3 marks)
 (c) Why is a tall person more likely to topple (fall down) when climbing a mountain than a short person? (2 marks)
 (d) A uniform meter rule is balanced at the 40cm mark when a load of 3N is hung at 10cm mark. Find the mass of the meter rule. (Take $g = 10\text{N/kg}$) (3 marks)
- 18) (a) Explain the meaning of the following terms:
 (i) Temperature of a substance. (1 mark)
 (ii) Heat of a substance. (1 mark)
 (iii) The lower fixed point on Celsius scale of temperature. (1 mark)

- (b) Mercury and alcohol are used in thermometers.
- (i) State two properties of these liquids which make them suitable for use in thermometers. **(2 marks)**
 - (ii) Why is the alcohol thermometer more suitable for measuring low temperature? **(2 marks)**
- (c) Convert 30°C to Kelvin scale of temperature. **(2 marks)**
- (d) Why does a clinical thermometer have a constriction above its bulb? **(1 mark)**
- 19) (a) Explain the meaning of the following terms:
- (i) A good conductor of electricity. **(1 mark)**
 - (ii) A bad conductor of electricity. **(1 mark)**
- (b) Which of the following has more resistance to the flow of electric current: A long thin good conductor wire of electricity and a short thick good conductor wire? Explain your answer. **(3 marks)**
- (c) Three resistors of 2 Ohms, 4 Ohms and 6 Ohms are first connected in series and then disconnected and again connected in parallel. Determine the resistance:
- (i) In series. **(1 mark)**
 - (ii) In parallel. **(2 marks)**
- (d) What are the advantages of connecting resistors in parallel in a simple electric circuit? **(2 marks)**
- 20) (a) Describe the structure of a simple mercury barometer. **(4 marks)**
- (b) A height of the mercury column in a barometer is found to be 67.0 cm at a certain place. What would be the height of a water barometer at the same place? Density of mercury $1.36 \times 10^4 \text{ kg/m}^3$ and the density of water is $1.0 \times 10^3 \text{ kg/m}^3$ **(3 marks)**
- (c) A man blows into one end of a U - tube containing water until the levels differ by 40.0cm. If the atmospheric pressure is $1.01 \times 10^5 \text{ N/m}^2$ and the density of water is 1000 kg/m^3 , calculate his lung pressure. **(3 marks)**

SECTION C: ATTEMPT ONE QUESTION ONLY.**(15 MARKS)**

21) The table below shows the velocity of a moving body and the time taken by the body.

Time/ s	Velocity/ m.s^{-1}
0	0
1	2
2	4
3	6
4	8
5	10

- (a) Plot a graph of velocity along the vertical axis and time along the horizontal axis using the data given in the above table. **(10 marks)**
- (b) Determine the slope of the graph. Show on the graph how you find the slope. **(3 marks)**
- (c) What does the slope represent? **(1 mark)**
- (d) From the graph, determine the velocity of the body when time is 2.5s. **(1 mark)**
- 22) In an experiment to measure the unknown resistance by the ammeter – voltmeter method, a student obtained the following results.

Voltmeter reading/V	Ammeter reading/A
2.0	1.0
3.0	1.5
4.0	2.0
5.0	2.5
6.0	3.0
7.0	3.5

- (a) Plot the graph of potential difference, V (y – axis) against current, I (x – axis). **(10 marks)**
- (b) Determine the slope of the graph. Show on the graph how you find the slope. **(3 marks)**
- (c) State the relationship between the resistance, potential difference and current. **(2 marks)**

END

PHYSICS I MARKING SCHEME

ORDINARY LEVEL NATIONAL EXAMINATIONS, 2015

1. Density = $\frac{\text{mass}}{\text{volume}} = \frac{96 \times 10^{-3}}{12 \times 10^{-6}} = 8 \times 10^3 \text{kg/m}^3$

2.

Distance	Displacement
<ul style="list-style-type: none"> - A scalar quantity - Has only magnitude - Length covered by a moving body. 	<ul style="list-style-type: none"> - A vector quantity - Has both magnitude and direction - Distance covered in a specific direction.

3. a) Acceleration is the rate of change of velocity

b) $u = 98 \text{km/h} = \frac{98000}{3600} = 27.2 \text{m/s}$

$v = 48 \text{km/h} = \frac{48000}{3600} = 13.3 \text{m/s}$

Deceleration = $\frac{u-v}{t} = \frac{27.2-13.3}{10} = 1.39 \text{ m/s}^2$

4. Passengers continue to move in order to resist any change in the state of motion due to Inertia.

5. a) work

b) $W = f \times d = 5000 \times 100 = 500,000 \text{J.}$

6. a) Mechanical advantage is a ratio of load to effort. Or $M.A = \frac{\text{Load}}{\text{Effort}}$

b) The mechanical advantage depends on load and effort. (friction) or output and input force.

c) $\eta = \frac{M.A}{V.R} \times 100\%.$

d) Pulleys are used for lifting loads.

7. a) A heavy parcel exerts a force over a small area of the string thus a great pressure is produced and then the hand feels pain.

$$b) F = P.A = 1000 \times 0.5 = 500N.$$

8. a) Specific latent heat of a substance is the amount of heat required to transform a unit mass of a substance from one state to another at constant temperature.

$$b) Q = ml + mc\Delta\theta$$

$$17600 = 0.008L + 0.008 \times 4200 \times 100$$

$$17600 = 0.008 L + 3360$$

$$L = \frac{14240}{0.008} = 1780000J/kg$$

9. a) The sun, stars, glow worm etc.

b) A light ray is a direction or path along which light energy travels.

c) Diverging beam or parallel beam.

d) Light travels in straight lines.

10. a) - The incident ray, the reflected ray and the normal line all lie in the same plane.
- Angle of incidence = Angle of reflection

b) A simple periscope is made of a long tube and two plane mirrors fixed at 45° , parallel and facing each other.

c) A simple periscope is used to see the objects hidden from direct view.

11. a) Plastics do not conduct electricity, so it is used for safety reasons to avoid electrification (short circuit) OR Plastic is a bad conductor of electricity (insulator) so it protects us from electrocution.

b) Not considered.

12. a) i) Potential energy is energy possessed by a body because of its position.

$$P.E = mgh \text{ (} m = \text{mass, } g = \text{gravity, } h = \text{height)}$$

ii) Kinetic energy is the energy possessed by a body because of its motion. $K.E = \frac{1}{2}mv^2$

$$b) K.E = \frac{1}{2}mv^2 = \frac{1}{2} \times 1000 \times (20)^2 = 200,000J$$

13. a) Can't be recharged, high internal resistance, less e.m.f, irreversible chemical reaction.

b) Can be recharged, low internal resistance, high e.m.f, and Reversible chemical reaction.

c) Cameras, Telephone, Radio, Cars.

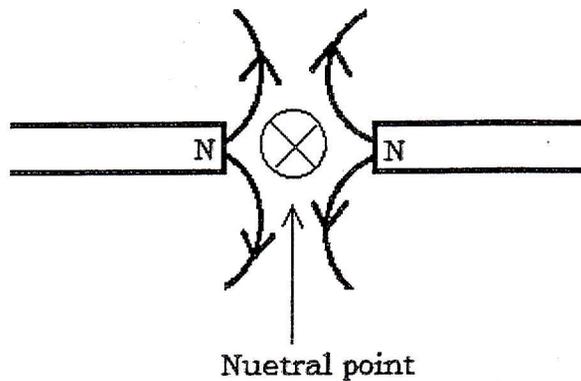
14. a) by electric current, by stroking (or contact), by induction

b) By hammering, by heating, by electric method using A.C.

15. a) A magnetic field is a region where magnetic forces are detected. Or it's a region around a magnet where a magnetic force is experienced.

- b) Magnetic fields are vectors because they are oriented north to south around a magnet or because they have directions.
- c) Neutral point is a point between two like poles of magnets where the magnetic net force is zero.

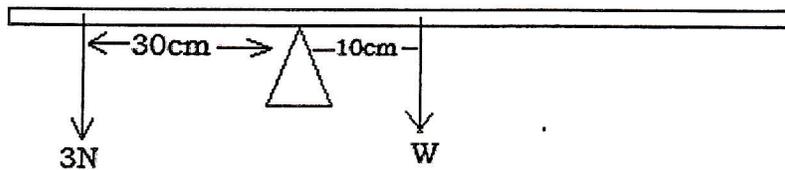
Or



SECTION B:

16. a) - The incident ray, refracted ray and the normal line all lie in the same plane.
 - The ratio of the speed of light in a vacuum to the speed of light in the material is a constant equal to the refractive index.
- b) The speed of light in air is greater than the speed of light in a glass block.
- c) i) Because white light is composed of many colours and each colour has its own speed.
 Or Because different colours have their own refractive indices for different colours by the glass prism.
- ii) Violet
 iii) Red
 iv) Red, orange, yellow, green, blue, indigo and violet.
- d) i) Converging lens
 ii) Diverging lens
17. a) The center of gravity of a body is a point where all the weight of a body is concentrated or it's the point of application of resultant force due to earth's attraction (weight)
- b) stable, unstable, neutral.
- c) Because the centre of gravity of a tall person is higher than that of a short person which makes him/her to be unstable.

d)



Clockwise moment = Anti clockwise movement

$$W \times 0.1 = 3 \times 0.3$$

$$W = \frac{0.9}{0.1} = 9\text{N}$$

$$W = mg$$

$$m = \frac{w}{g} = \frac{9}{10} = 0.9\text{kg.}$$

18. a) i) Temperature is the degree of hotness or coldness.

ii) Heat is a form of energy that is transferred from one body to another due to temperature difference.

iii) The lower fixed point on celcius scale is the melting point of pure ice which is 0°C.

b) i) - They are sensitive to the change in temperature

- They expand regularly

- They have clean colours (easily seen or opague)

- They do not wet glass

- They have low specific heat capacities

- They are good conductors of heat.

ii) It has a low freezing point or alcohol doesn't solidify easily.

c) $T = ^\circ\text{C} + 273$
 $= 30 + 273 = 303\text{K}$

d) Because it prevents mercury from flowing back to the bulb.

19. a) i) A good conductor of heat is one which has a low resistance or its one which allows the flow of current easily or its one where electrons are free to move.

ii) A bad conductor is one which has a high resistance or it doesn't allow the flow of current or it's a material in which the electrons do not move.

b) A long thin wire because the resistance of the wire increases with length or a long thin wire's resistance is directly proportional to the length of the wire and inversely proportional to the cross section area.

c) i) $R = R_1 + R_2 + R_3 = 2 + 4 + 6 = 12 \Omega$

ii) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{2} + \frac{1}{4} + \frac{1}{6} = \frac{11}{12}$

$$R = \frac{12}{11} \Omega$$

or 1.09Ω

d) - When one resistor is removed, current continues to flow.

- The net resistance in parallel is less than in series.

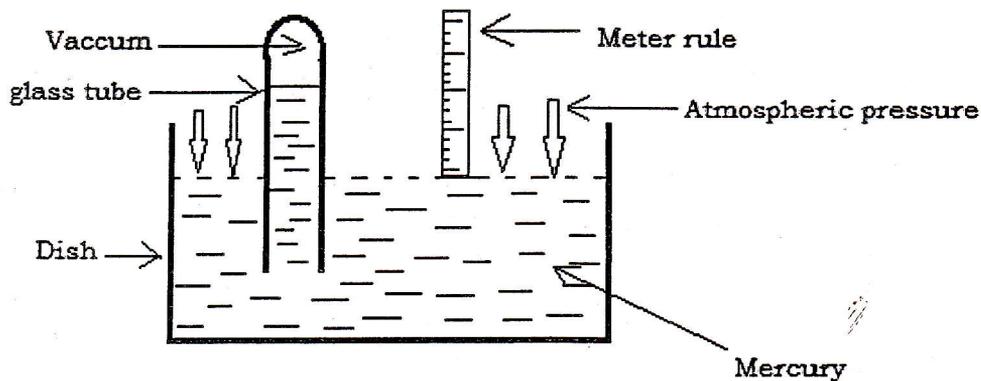
- In parallel, the resistors have the same voltage.

20. a) - A dish containing mercury

- A 1m thick glass tube closed at one end, full of mercury and inverted in the dish.

- A meter rule to measure the level of mercury remaining in the tube.

OR



b) $P_{Hg} = P_w$

$$P_{Hg} g h_{Hg} = P_w g h_w$$

$$h_w = \frac{P_{Hg} h_{Hg}}{P_w} = \frac{1.36 \times 10^4 \times 0.67}{1000} = 9.112m$$

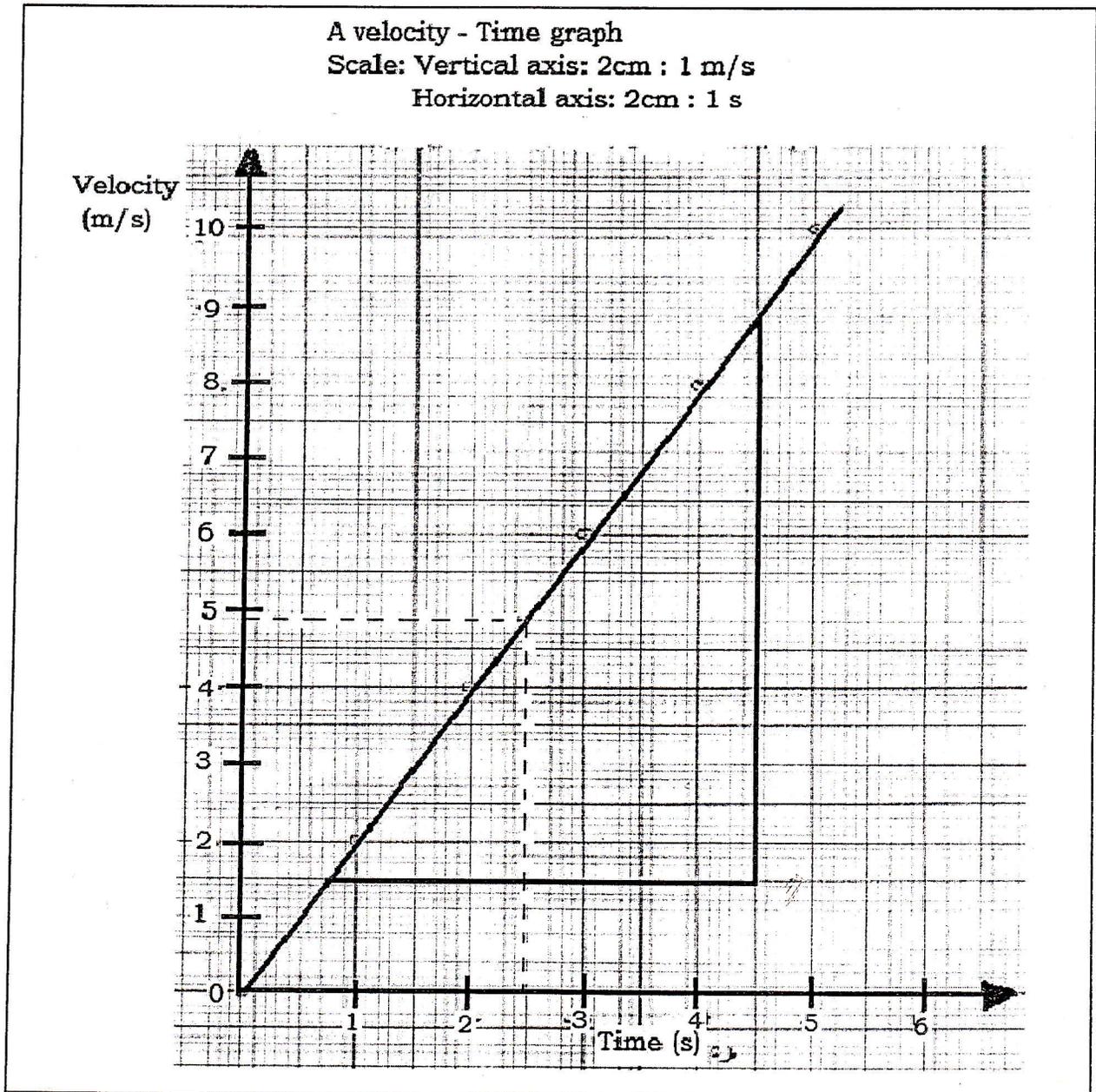
c) Lung pressure = $P_{atm} + P_{gh}$

$$= 1.01 \times 10^5 + 1000 \times 10 \times 0.4$$

$$= 105 \times 10^3 \text{ Or } 1.05 \times 10^5 \text{ Pa.}$$

SECTION C

21. a)

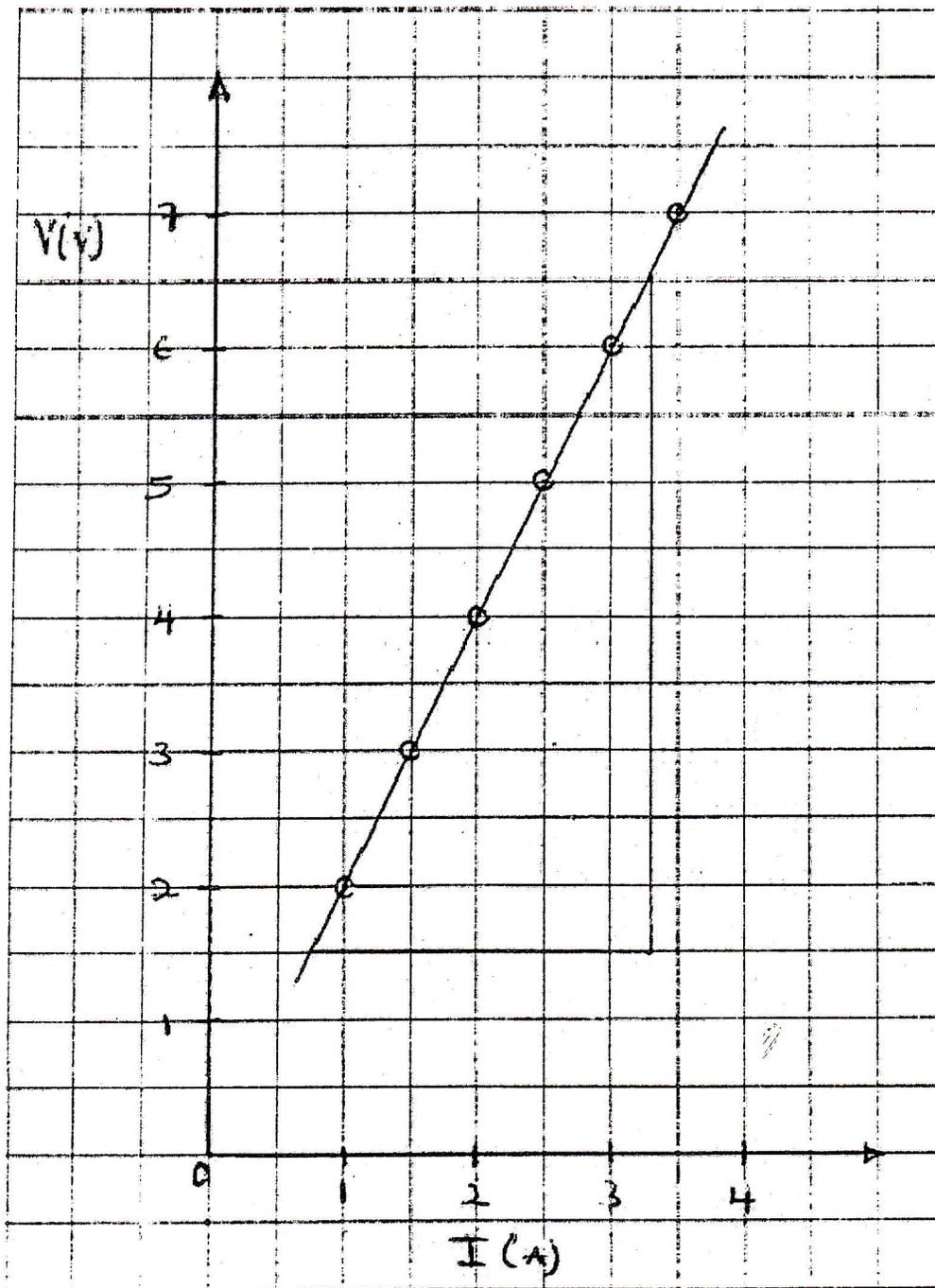


$$b) S = \frac{\Delta v}{\Delta t} = \frac{10 - 4}{5 - 2} = \frac{6}{3} = 2 \text{ m/s}^2$$

c) Uniform acceleration.

d) From the graph, the velocity of the body when $t = 2.5\text{s}$ is $4.9\text{m/s} \approx 5.0\text{m/s}$

22. a)



$$b) S = \frac{\Delta v}{\Delta I} = \frac{7-2}{3.5-1} = 2\Omega$$

$$c) \text{ Resistance} = \frac{\text{Potential difference}}{\text{Current}}$$

$$R = \frac{V}{I} \text{ or } V = IR$$

END