ZERAKI ACHIEVERS HOLIDAY ASSIGNMENT 1
TERM 2 2021
PHYSICS (QUESTION PAPER)
FORM 3

Name……Adm no…….
School……. Class…….
Signature……Date…….

Instructions:

a) Write your name and admission number in the spaces provided above.
b) Sign and write the date of examination.
c) Answer all the questions in this question paper.

The following topics are covered in this holiday assignment:

- Current electricity
- Waves
- Refraction
- Quantity of heat
- Gas laws

Students are encouraged to FIRST study the topics above before attempting to do the questions below.

1. State Ohm's law. (1mrk)

a) A dry cell of emf E and an internal resistance of r is used to drive a current through various resistors of resistance R and the values of $\frac{1}{I}$ and R plotted on a graph in figure 1 below

Figure 1

The variables I and R are related by the equation $\frac{1}{I} = \frac{R}{E} + \frac{r}{E}$:

(i) Using the graph in figure 1, determine the emf, E of the cell. (4mrks)

(ii) Show that the internal resistance r of the cell is given by r = -R intercept and hence determine r. (3mrks)

b) A cell supplies a current of 0.5A when connected to a 2Ω resistor and 0.25A when connected to a 5Ω resistor. Find the e.m.f and the internal resistance of the cell. (4mks)

c) The figure 2 below shows a circuit that can be used to verify Ohm's law

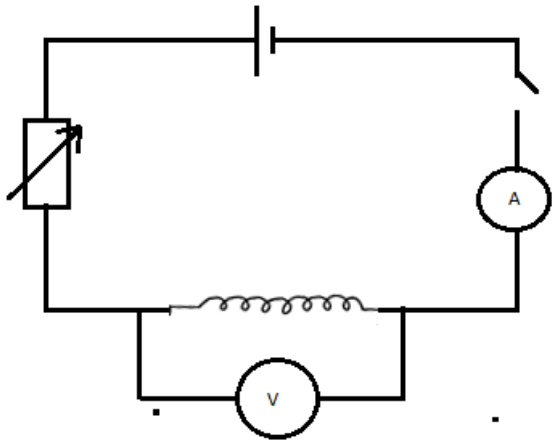

Figure 2

Explain briefly how the setup can be used to verify ohm's law (3mks)

d) The graph below was obtained from experiment to determine the effective resistance of two resistors connected in parallel. If the value of one resistor is 50 ohms. Determine the value of the other resistor.

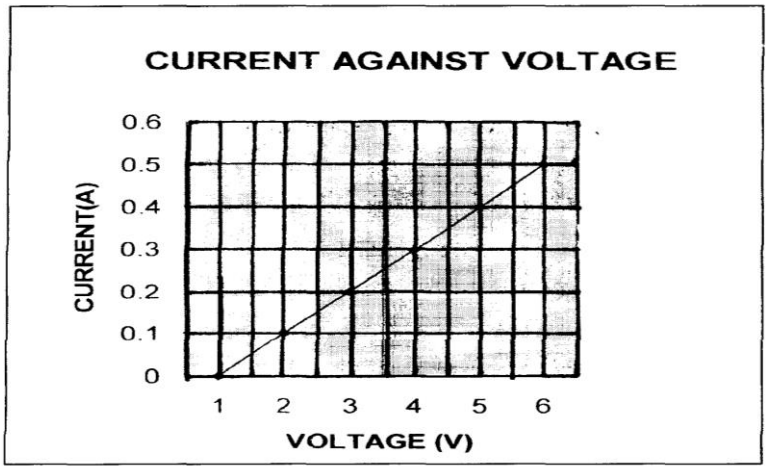

Figure 3

From the graph,
Determine

i) Effective resistance of the two resistors (2mk)

ii) The value of the other resistor (3mks)

2.

a) Students set up a mass attached to a spring such that when it oscillates it taps on water surface in a wide shallow tank as in figure 4 below.

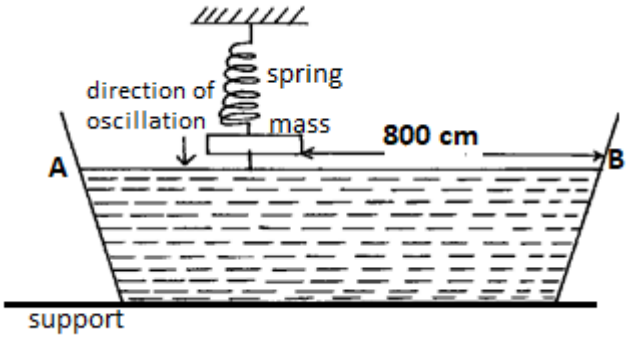

Figure 4

The students measured time for 20 oscillations and found that the mass takes 36 seconds. Determine:

i. The periodic time of the mass (2mks)

ii. The frequency of the waves produced on the water surface (1mk)

iii. The speed of the waves if the students counted four ripples between the mass and end **B** of the tank (3mks)

b) State one example of longitudinal wave. (1 mk)

c) Figure 5 shows how the displacement of a certain wave varies with time.

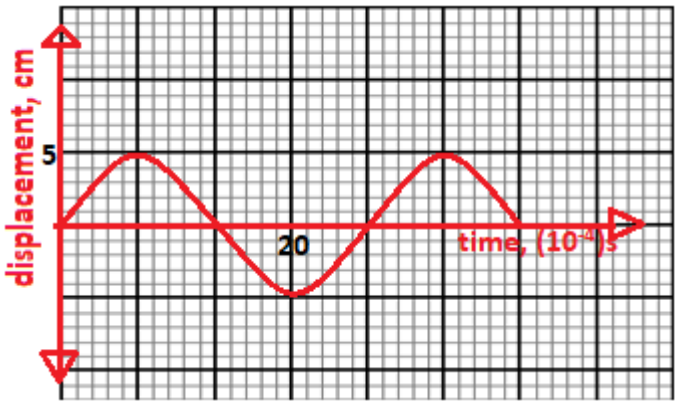

Figure 5

Determine the frequency of the wave. (2 marks)

d) Figure 6– shows two identical loud speakers L_1 and L_2 producing some sound and placed at an equal distance from a path AB.

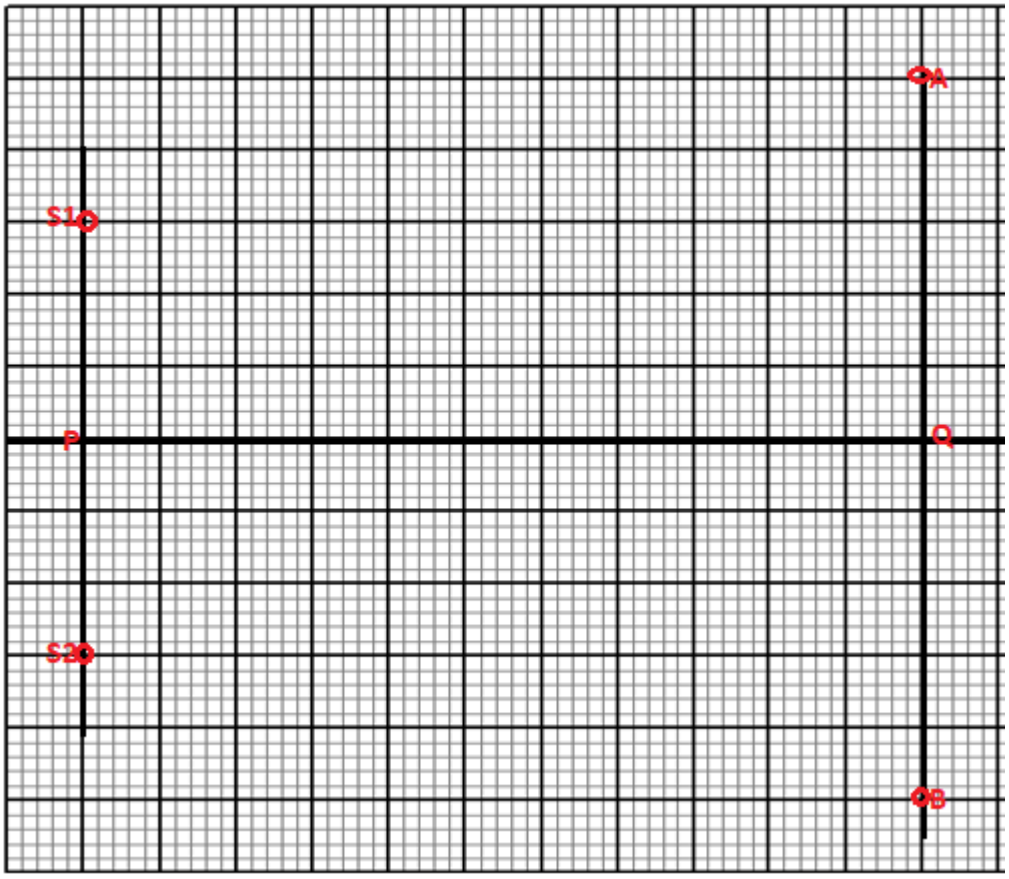

Figure 6

i. A passerby walks along path A B and hears alternating loud and soft sounds. State the reason for loud sound. (1 mark)

ii) State the observation made when one of the loud speaker is replaced with another speaker producing sound at a higher frequency. (1 mark)

iii) State one condition for the formation of a stationary wave. (1 mark)

e) Figure 7– shows water wave fronts incident on an opening AB

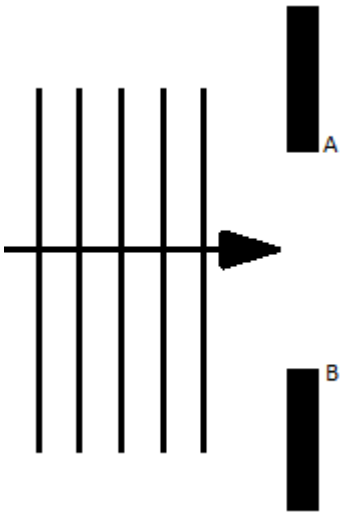

Figure 7

i. On the same diagram sketch the wave fronts obtained after the waves passes the opening AB. (1 mark)

ii. State one difference that would be observed on the wave if the opening AB was reduced to a narrow opening. (1 mark)

e) State any **two** factors that would increase the speed of sound in air. (2mark)

f) An echo sounder of a ship received the reflected waves from a sea bed after 0.20s.
(i) Determine the depth of the sea bed if the velocity of sound in water is 1450m/s (2mks)

(ii) When the ship above passes over a sunken reef, the echo sounder receives an echo after 0.16s. Determine the height of the sunken reef. (2mks)

3.

a) State what is meant by refractive index of a material. (1 mark)

b) Figure 8represents a ray of light falling normally on the curved surface of a semi-circular plastic block at X, meeting the opposite face at an angle of incidence of 30^0 and emerging into the air at an angle of 40^0.

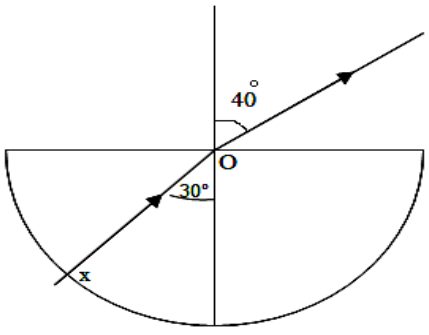

Figure 8

i. State and explain what happens to the ray as it moves from:

I. Air to block at X. (1marks)

II. From block to air at O. (1marks)

III. Calculate refractive index of the block. (3marks)

c) Describe how the apparatus above could be used to find the critical angle experimentally. (3marks)

4.

a.

i. Distinguish heat capacity from specific heat capacity. (2 marks)

ii. A well-lagged calorimeter contains 0.1 kg of water and has an electric immersion heater in the liquid. A second identical calorimeter contains 0.1 kg of paraffin and an identical heater. Both liquids are initially at 20^{o}C. The heaters are switched on at the same instant. If the paraffin reaches a temperature of 30^{o}C in 10 minutes, how long will it take for the water to attain this temperature? Assume the thermal capacity of the calorimeters and any heat losses are negligible. (4 marks)

Specific heat capacity of paraffin = 2100 J/kg K. Specific heat capacity of water = 4200 J/kg K.

b. The figure 9 below shows a block of ice with two heavy weights hanging such that the copper wire / string connecting them passes over the block of ice.

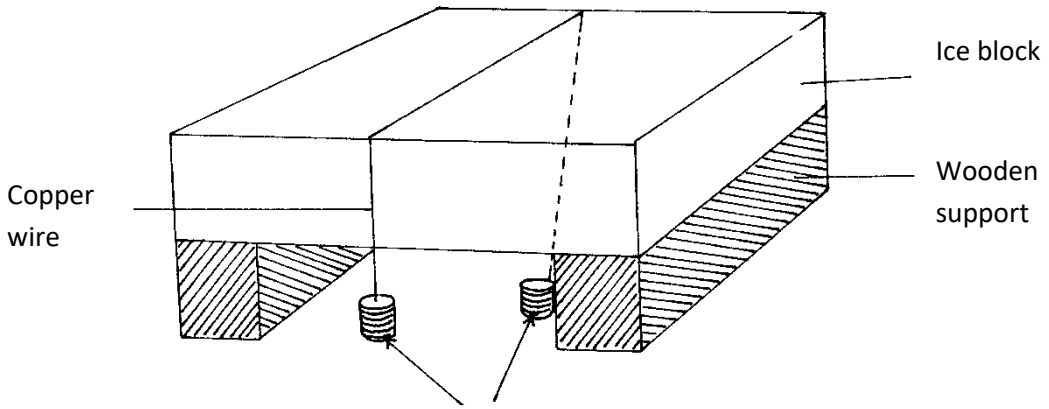

Figure 9

i) It is observed that the wire gradually cuts its way through the ice block, but leaves it as one piece. Explain (3 marks)

ii) What change would be observed if the copper wire used in the experiment was replaced by a cotton thread? Explain your answer. (2 marks)

c. State two factors which affect the rate of cooling. (2 marks)

5.

a.

i. State Boyle's law. (1 mark)

ii. The diagram (figure 10) shows a set-up that may be used to verify Boyle's law.

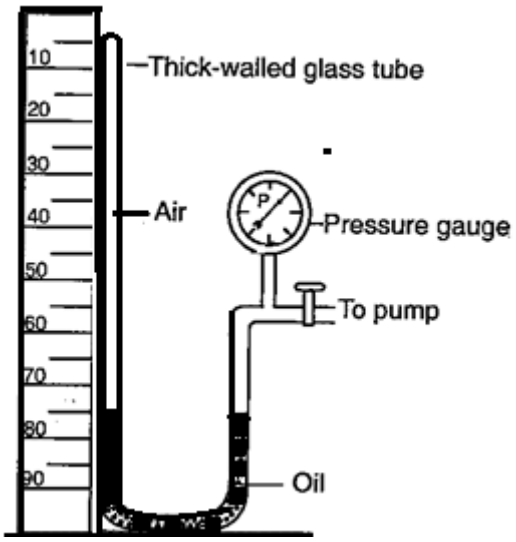

Figure 10

i. Describe the measurements that should be taken in the experiment. (2 marks)

ii. Explain how the measurements taken in (i) above may be used to verify Boyle's law. (3 marks)

iii. What is the significance of the area under the graph of Pressure against Volume? (1 mark)

b. 4200 cm^3 of oxygen at 30°C and a pressure of 1 atmosphere is compressed to 1600 cm^3 at 2.3 atmospheres. What is the Celsius temperature of the gas. (3marks)

6.

a. State the pressure law for an ideal gas (1mark)

b. The set up (figure 11) shows an arrangement to determine the relationship between temperature and pressure of a gas constant volume.

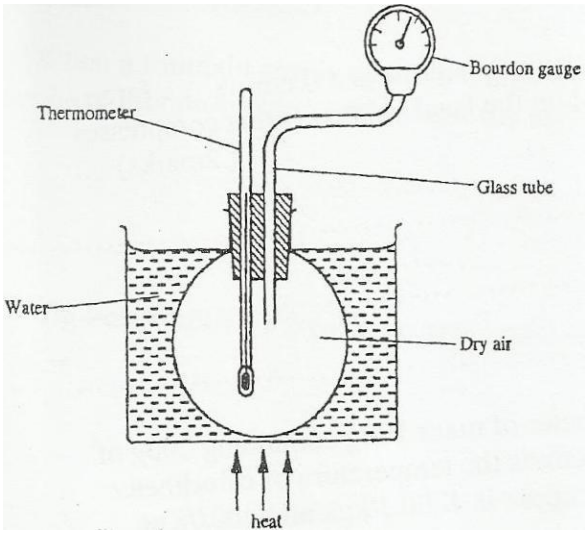

Figure 11

i. Explain how pressure measurements are obtained in the experiment. (3marks)

ii. Explain how the result from the experiment can be used to determine the relationship between temperature and pressure. (2marks)

c. A bicycle tire is pumped to a pressure of 2.2×10^5pa at23^0C. After a race the pressure is found to be 2.6×10^5 pa. Assuming the volume of the tire did not change, what is the temperature of the air in the tire. (3marks)

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