SMJK YU HUA
MID YEAR EXAMINATION 2014

Subject : Physics Paper 3
Form : 5A – 5F
Date : 12.5.2014 / Monday
Time : 8.35 – 10.05 Pagi
No. of Candidates : 278
No. of printed pages : 4

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Name :_____
Class : _____

This question paper consists of 2 sections: **Section A** and **Section B**. The time suggested to answer **Section A** is 60 minutes and **Section B** is 30 minutes.

Section A
[28 marks]
Answer **all** questions

1 An experiment is carried out to investigate the relationship between the length of a wire, ℓ and its resistance , R. The arrangement of the apparatus is shown in Diagram 1.1. A rheostat, a switch, an ammeter, a constantan wire and dry cells are connected in series.
A voltmeter is used to measure the potential difference, V, across the constantan wire between X and Y.

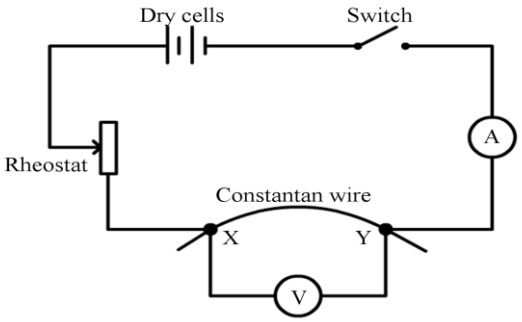

Diagram 1.1

A constantan wire of length, ℓ = 30.0 cm is connected between X and Y. When the switch is on, the rheostat is adjusted till the ammeter reading is 0.2 A. The voltmeter reading, V, is as shown in Diagram 1.2.
The procedure is repeated with constantan wires of length, ℓ = 40.0 cm, 50.0 cm, 60.0 cm, 70.0 cm and 80.0 cm. The corresponding voltmeter readings across X and Y are shown in Diagram 1.3, 1.4, 1.5, 1.6 and 1.7.

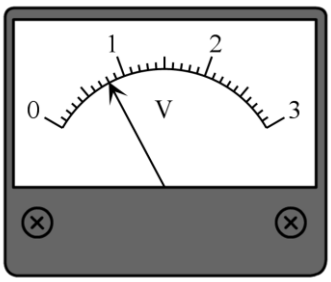

Diagram 1.2
ℓ = 30.0 cm
V = ...
R = …….

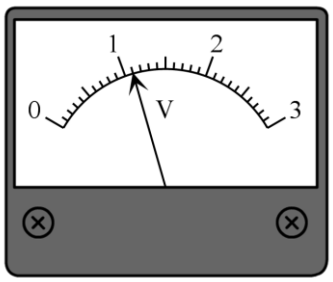

Diagram 1.3
ℓ = 40.0 cm
V = ……
R = ……

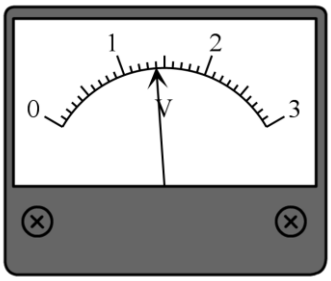

Diagram 1.4
ℓ = 50.0 cm
V = …….
R = …….

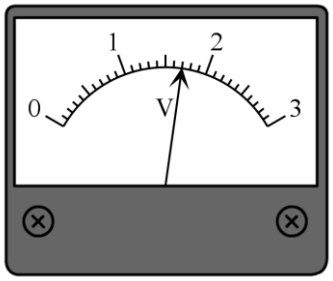

Diagram 1.5
ℓ = 60.0 cm
V = ……
R = …….

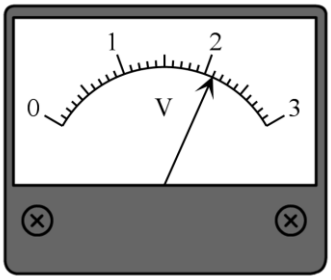

Diagram 1.6
ℓ = 70.0 cm
V = ……
R = ……

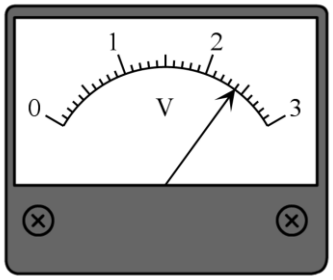

Diagram 1.7
ℓ = 80.0 cm
V = ……..…
R = ……..

(a) For the experiment described, identify:

(i) The manipulated variable

_____ [1 mark]

(ii) The responding variable

_____ [1 mark]

(iii) The constant variable

_____ [1 mark]

(b) Based on Diagram 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7:

(i) Record the voltmeter readings, V in the space provided. [2 marks]

(ii) Calculate the values of R for each length of wire using the formula $R = \frac{V}{I}$ and record the readings in the space provided. [2 marks]

(iii) Tabulate your results for V and R for all values of ℓ. [3 marks]

(c) Plot a graph of R against ℓ on a piece of graph paper. [5 marks]

(d) Based on your graph in **1**(c), state the relationship between R and ℓ. [1 mark]

2 An experiment is carried out to investigate the relationship between the mass, m, of a load placed on a spring and the length, ℓ, of the spring. Spring constant, k, is determined.
The result of this experiment is shown in the graph of ℓ against m in Diagram 2.1.

Graph of ℓ against m

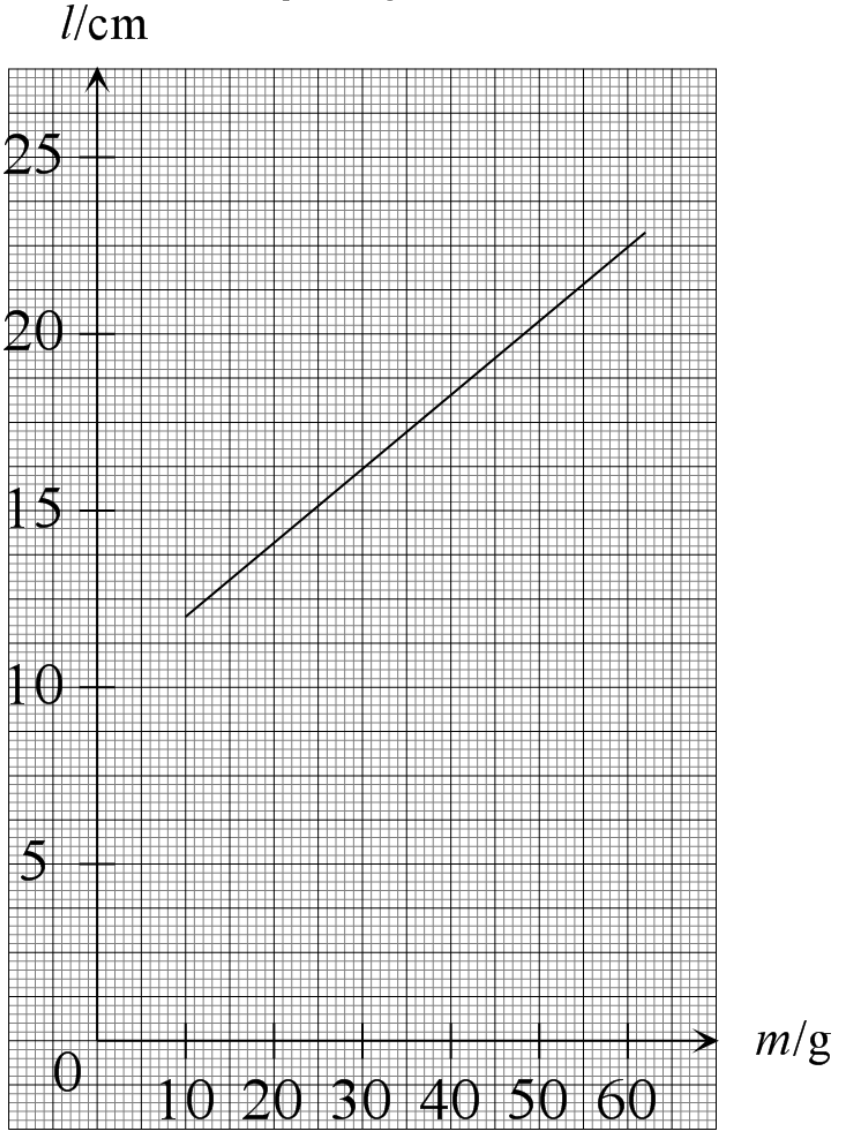

Diagram 2.1

(a) Based on the graph in Diagram 2.1,
(i) state the relationship between ℓ and m.

_____

[1 mark]

(ii) determine the value of ℓ when m = 0 g.
Show on the graph how you determine the value of ℓ.
ℓ = _____

[2 marks]

(b) The spring constant, k, is given by the formula $k = \frac{1}{c}$, where c is the gradient of the graph.

(i) Calculate the gradient, c, of the graph. Show on the graph how you calculate c.

c = _____

[3 marks]

(ii) Determine the value of k.

k = _____

[1 mark]

(c) Another identical spring is connected in series to the end of the spring.
The spring constant, k', of the two springs in series is given by the formula

$$\frac{1}{k'} = \frac{1}{k} + \frac{1}{k}$$

Calculate k'.

k' = _____

[3 marks]

(d) State **two** precautions that can be taken to improve the accuracy of the readings in this experiment.

_____

_____

_____

_____

_____

[2 marks]

Section B

[12 marks]

Answer any **one** from this section.

3 Diagram 3.1 shows a boy sitting on a spring horse in a playground.

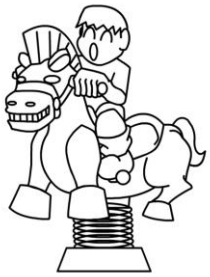

Diagram 3.1

Diagram 3.2 shows two boys sitting on a same spring horse.

Diagram 3.2

Observe the length of the spring of the spring horse in both situations.
Based on the observation:

(a) State **one** suitable inference.

[1 mark]

(b) State **one** suitable hypothesis.

[1 mark]

(c) With the use of apparatus such as a spring, slotted weights and other apparatus, describe an experiment to investigate the hypothesis stated in (b).
In your description, state clearly the following:

(i) Aim of experiment
(ii) Variables in the experiment
(iii) List of apparatus and materials
(iv) Arrangement of the apparatus
(v) The procedure of the experiment which include the method of controlling the manipulated variable and the method of measuring the responding variable
(vi) The way to tabulate the data
(vii) The way to analyse the data

[10 marks]

4 Diagram 4.1 shows the surface of the water is touched with two fingers simultaneously.
Diagram 4.2 shows the surface of the water is touched with fingers further apart.
When the fingers are further apart, the distance between the ripples becomes less.

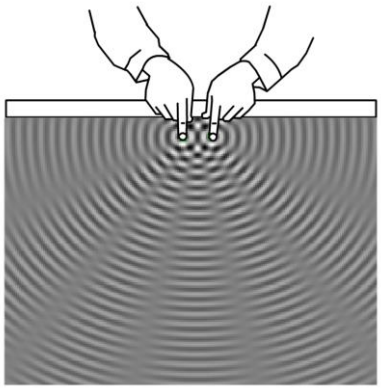

Diagram 4.1

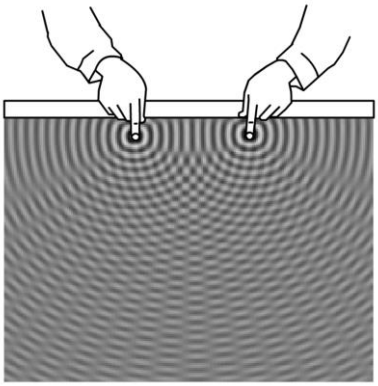

Diagram 4.2

Based on the information and observation above:

(a) State **one** suitable inference.

[1 mark]

(b) State **one** suitable hypothesis.

[1 mark]

(c) With the use of apparatus such as a ripple tank with two dippers and other apparatus, describe **one** experiment to investigate the hypothesis stated in (b).
In your description, state clearly the following:

(i) The aim of experiment
(ii) The variables in the experiment
(iii) The list of apparatus and materials
(iv) The arrangement of the apparatus
(v) The procedure of the experiment which include **one** method of controlling the manipulated variable and **one** method of measuring the responding variable
(vi) The way to tabulate the data
(vii) The way to analyse the data

[10 marks]

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Answer:

1 (a) (i) The length of the constantan wire
(ii) The resistance of the constantan wire
(iii) the diameter of the constantan wire

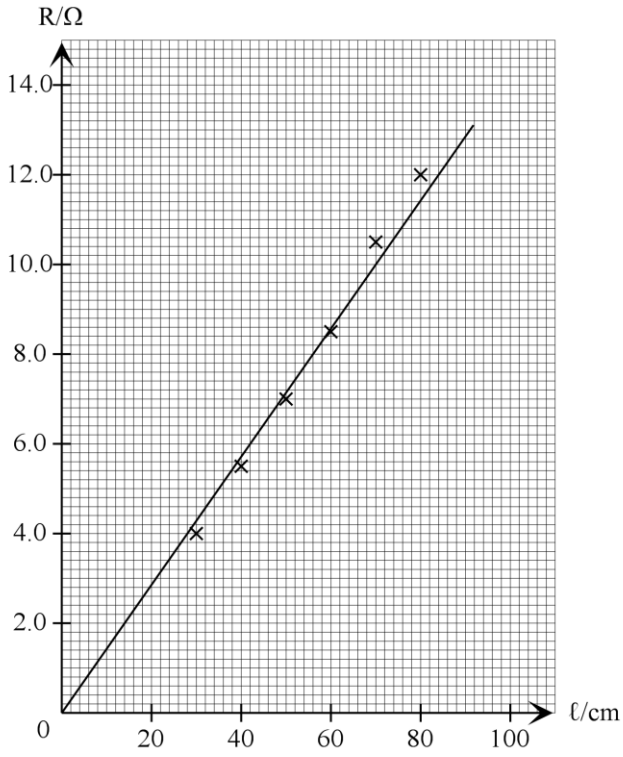
(b) (i) Diagram 1.2: 0.8 V, Diagram 1.3: 1.1 V, Diagram 1.4: 1.4 V, Diagram 1.5: 1.7 V, Diagram 1.6: 2.1 V, Diagram 1.7: 2.4 V.

(ii) Diagram 1.2: 4.0 Ω, Diagram 1.3: 5.5 Ω, Diagram 1.4: 7.0 Ω, Diagram 1.5: 8.5 Ω, Diagram 1.6: 10.5 Ω, Diagram 1.7: 12.0 Ω.

(iii)

ℓ	**I/A**	**V/V**	**$R = \frac{V}{I}$ /Ω**
30	0.2	0.8	4.0
40	0.2	1.1	5.5
50	0.2	1.4	7.0
60	0.2	1.7	8.5
70	0.2	2.1	10.5
80	0.2	2.4	12.0

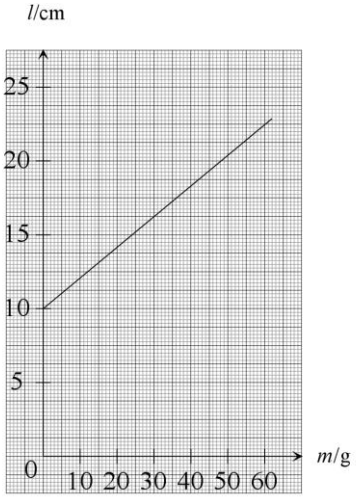
(c)



(d) Resistance of wire, R, is directly proportional to length of wire, ℓ.

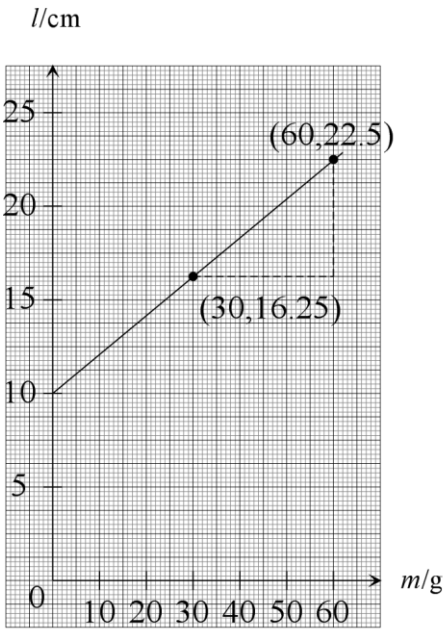
2 (a) (i) ℓ is directly proportional to m

(ii) $\ell = 10$ cm



(b) (i) $c = \dfrac{22.5 - 16.25}{60 - 30}$

$c = \dfrac{6.25}{30} = 0.208 \text{ cm g}^{-1}$



(ii) $k = \dfrac{1}{0.208} = 4.808 \text{ g cm}^{-1}$

(c) $\dfrac{1}{k'} = \dfrac{1}{k} + \dfrac{1}{k}$

$\dfrac{1}{k'} = \dfrac{1}{4.808} + \dfrac{1}{4.808}$

$\dfrac{1}{k'} = \dfrac{2}{4.808}$

$k' = 2.404 \text{ g cm}^{-1}$

(d) Ensure the system is in the stationary state when readings are being taken

The experiment is repeated and the average readings are recorded

3 (a) The extension of the spring is depends on the force applied

(b) The extension of a spring increases when the applied force increases

(c) (i) Aim of experiment:

To investigate the relationship between the force applied, *F*, and the extension, *x* of a spring

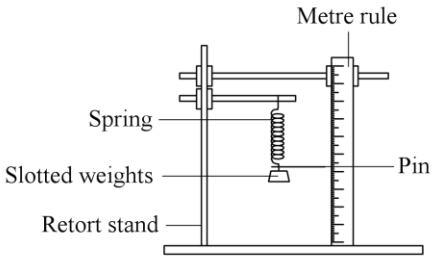
(ii) Variables in the experiment:

Manipulated: The force applied, *F*
Responding: The extension of the spring, *x*
Constant: The material used to make a spring

(iii) List of apparatus and materials:

Spring, slotted weights, retort stand with clamp, meter rule, pin and plasticine

(iv) Arrangement of the apparatus:



(v) Procedure:

1. A meter rule is clamped vertically to the retort stand.
2. The initial position of the pin is recorded as x_0.
3. A slotted weight of 0.1 kg is attached to the end of the spring. The new position, x' of the pin is measured by using ruler and recorded.
4. The extension of the spring is calculated as $x = x' - x_0$.
5. Step 3 and 4 are repeated using 0.2 kg, 0.3 kg, 0.4 kg and 0.5 kg.

(vi) Tabulate the data:

Mass, *m*/kg	**Force, *F*/N**	**Length of the spring, *x*'/cm**	**Spring extension, *x*/cm**
0.1	1.0		
0.2	2.0		
0.3	3.0		
0.4	4.0		
0.5	5.0		

(vii) Analyse the data:

Plot a graph of force, *F*, against extension of spring, *x*

(a) Distance between two consecutive antinodal lines depends on the distance between two coherent sources of waves

(b) The distance between two consecutive antinodal lines decreases as the distance between two coherent sources of waves increases

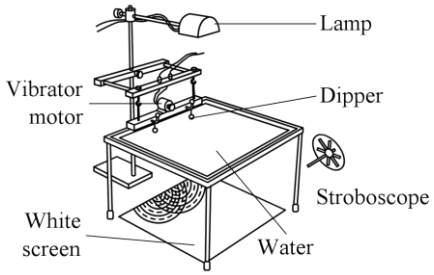
(c) (i) Aim of experiment:
To investigate the relationship between the distance between two consecutive antinodal lines and the distance between two coherent sources of waves

(ii) Manipulated variable: Distance between two coherent sources, a
Responding variable: Distance between two antinodal lines, x
Constant variable: Frequency of the vibrator/ Depth of water

(iii) List of apparatus and materials:

Power supply, ripple tank with two spherical dippers, stroboscope and meter rule

(iv) Arrangement of the apparatus:



(v) Procedure:

1. Power supply is switched on.
2. Experiment is started with the distance of two coherent sources, a = 2.0 cm.
3. Stroboscope is used to freeze the wave motion.
4. The distance between two antinodal lines, x is measured using the metre rule.
5. The experiment is repeated with a = 4.0 cm, 6.0 cm, 8.0 cm and 10.0 cm.

(vi) Tabulate the data:

Distance between two coherent sources, *a*/cm	**Distance between two consecutive antinodal lines, *x*/cm**
2.0	
4.0	
6.0	
8.0	
10.0	

(vii) Analyse the data:

Plot a graph of x against a