education

Department of Education
FREE STATE PROVINCE

PRACTICAL TASK

GRADE 11

PHYSICAL SCIENCES

JUNE 2017

MARKS: 40

TIME: 1 HOUR

This paper consists of EIGHT pages.

Name of learner: ..... Grade: .....

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INSTRUCTIONS AND INFORMATION

1. Write your name and grade in the appropriate spaces on the FRONT PAGE of this question paper.

2. Answer ALL questions in the spaces provided in THIS QUESTION PAPER.

3. You may use a non-programmable pocket calculator.

4. You may use appropriate mathematical instruments.

5. Show ALL the formulae and substitutions in ALL calculations.

6. Round off your final numerical answers to a minimum of TWO decimal places where necessary.

7. Give brief motivations, discussions, et cetera where required.

8. Separate information sheets are not attached. Relevant information you might need is as follows:

$$n = \frac{c}{v}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

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QUESTION 1

Mpho and Dikeledi want to investigate the propagation and refraction of light from one medium to another medium. The apparatus they use and the method they follow are indicated below.

APPARATUS

Ray box
Rectangular glass block
Paper
Pencil
Ruler
Protractor

METHOD

A Draw the normal where the light ray enters and exits the block.

B Draw a dot on the light beam close to the ray box. Draw a second dot at the point where the light enters the block. Draw a third dot at the point where the ray exits the block and a fourth dot on the light beam a short distance away from the block.

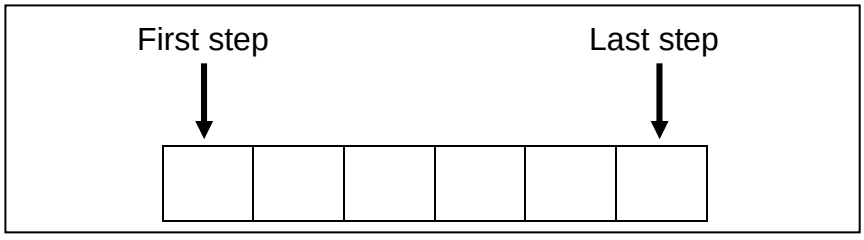
C Use your protractor to measure the angles of incidence and refraction at the surfaces where the light ray enters and exits the block.

D Turn on the ray box and aim the light ray at one of the block's long sides so that it strikes the block at an angle greater than zero. The light ray should enter the glass block.

E Place the glass block on a piece of paper and use your pencil to draw around the block to mark its outline.

F Remove the glass block and turn off the ray box. Use your ruler to join the four dots.

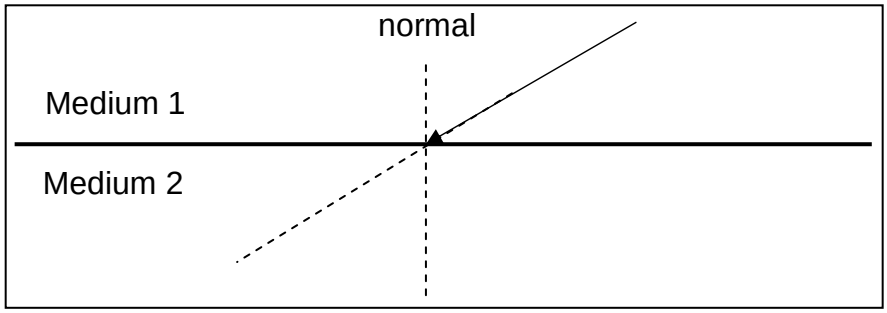
1.1 The steps given in the above method are NOT in the CORRECT sequence. Arrange them in the correct sequence by writing down ONLY the letters (**A** to **F**) in the correct sequence in the table below.



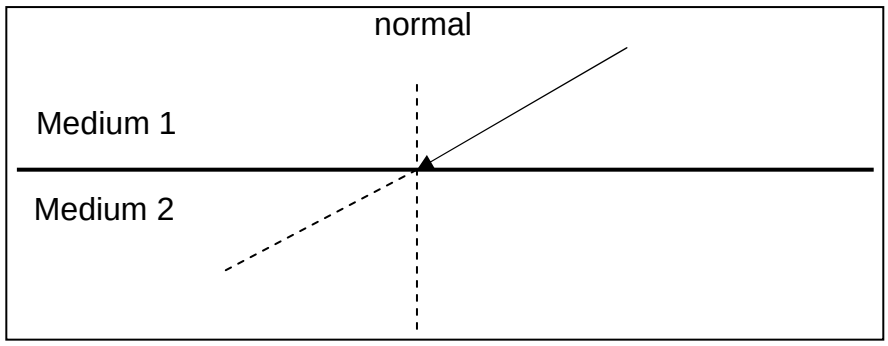
(2)

1.2 Mpho and Dikeledi conclude that when a ray of light strikes the interface between two media, it is refracted.

1.2.1 Complete the diagram below and draw the refracted ray if medium 1 has a HIGHER refractive index than medium 2. (2)



1.2.2 Complete the diagram below and draw the refracted ray if medium 1 has a LOWER optical density than medium 2. (2)



[6]

QUESTION 2

2.1 The table below shows accurate values for the refractive indices (relative to air) of some optical media. The optical densities of the media increase from water to diamond.

MEDIUM	REFRACTIVE INDEX
Water	1,33
Crown glass	1,52
Cubic zirconium	2,20
Diamond	2,42

Light is refracted at the interface between an unknown medium and water. The angle of incidence in the unknown medium is 20,28° and the angle of refraction in the water is 35°. Use a calculation to identify the unknown medium. (4)

_____

_____

_____

2.2 The refractive indices of three materials are given in the table below. Use it to answer QUESTIONS 2.1.1 and 2.1.2.

Substance	Refractive Index
Water	1,33
Glass	1,52
Diamond	2,42

2.2.1 What will the angle of refraction be if the incident angle is equal to the critical angle of a substance?

_____ (1)

2.2.2 Which ONE of the following interfaces has the largest critical angle? Draw a cross in the table to indicate your answer. (1)

Glass to water	
Diamond to water	
Diamond to glass	

2.3 Light travels from a medium with n = 1,63 to a medium with n = 1,42.

2.3.1 What happens to the speed of the light? Does it INCREASE, DECREASE or REMAIN THE SAME?

_____ (1)

2.3.2 What happens to the frequency of the light? Does it INCREASE, DECREASE or REMAIN THE SAME?

_____ _____ (1)

2.3.3 What happens to a ray of light that strikes the interface between two media parallel to the normal? (2)

_____

_____

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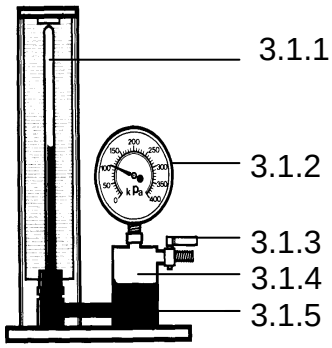
QUESTION 3

Boyle's law demonstrates the relationship between the volume and the pressure of a fixed mass of enclosed gas at constant temperature, and is usually done with the following apparatus.



3.1 Study the diagram above and label for the following parts.

3.1.1 _____ (1)

3.1.2 _____ (1)

3.1.3 _____ (1)

3.1.4 _____ (1)

3.1.5 _____ (1)

During such an experiment, the pressure on the enclosed mass of gas is increased by pumping air in through the tap.

3.2 Identify the following for this experiment:

3.2.1 Independent variable: _____ (1)

3.2.2 Dependent variable: _____ (1)

3.3 Write down TWO precautions for this experiment. (2)

_____

_____

_____

_____

_____

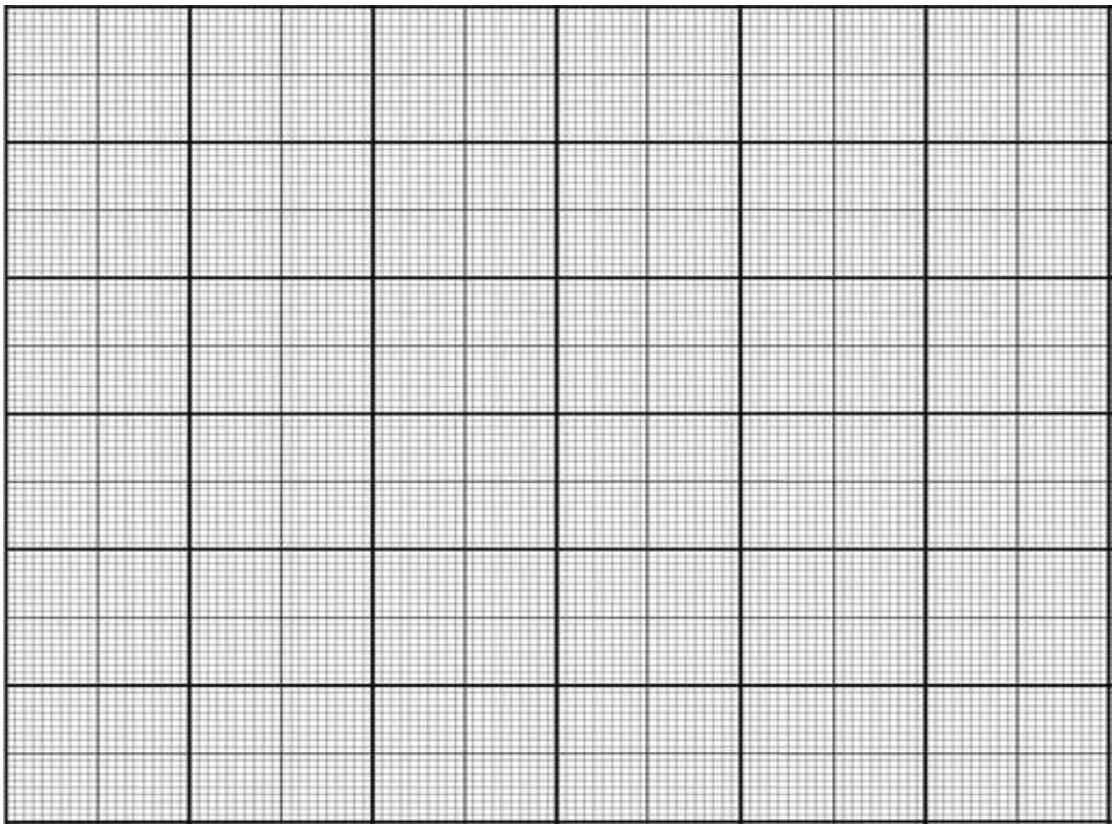
3.4 Consider the following incomplete table of results of volume (V) and pressure (p). Complete the table. (4)

Volume (cm^3)	**Pressure (kPa)**	$\frac{1}{p}$ **(kPa^{-1})**	**pV**
30	100		
35	85,5		
42	71,5		
50	60		

3.5 What is represented by the quantity pV? (1)

_____

3.6 Use the data from the table to draw a graph of volume versus $\frac{1}{\text{pressure}}$ for the enclosed gas on the graph paper below. Ensure that your graph has proper labels and suitable scales for the axes. Plot the points and draw the best-fit line. (6)



3.7 Write down the mathematical relationship between pressure and volume as represented in the graph. (2)

_____

3.8 Draw a conclusion from the results. (2)

_____

_____

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GRAND TOTAL: 40

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