**NAME: …………………………………………………….…………… INDEX NO. ……..……………**

**SCHOOL: ………………………………….………………………….. DATE:…………………………**

**CANDIDATE’S SIGN. …………………………………………...........**

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**232/3**

**PHYSICS**

**PAPER 3**

**INSTRUCTIONS TO CANDIDATES:**

* *Write your* ***name*** *and* ***index number*** *in the spaces provided above.*
* *Sign and write the* ***date*** *of the examination in the spaces provided above.*
* *You are supposed to spend the first 15 minutes of the 2 ½ hours allowed for this paper reading the whole paper carefully.*
* *Marks are given for a clear record of the observations actually made, their suitability, accuracy and the use made of them.*

**For Examiners’ Use Only**

**Question 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PART** | **A** | | | | | **B** | |
| **Marks Score** | b | c | e | f | g | h | i |
| 1 | 1 | 5 | 5 | 3 | 2 | 3 |
| **Candidate’s score** |  |  |  |  |  |  |  |

**Question 2**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PART** | **A** | | | **B** | | | | | |
| **Marks Score** | a | b | c | d | e(i) | e(ii) | e (iii) | e (iv) | f |
| 1 | 1 | 1 | 1 | 5 | 5 | 3 | 2 | 1 |
| **Candidate’s score** |  |  |  |  |  |  |  |  |  |

*This paper consists of 8 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

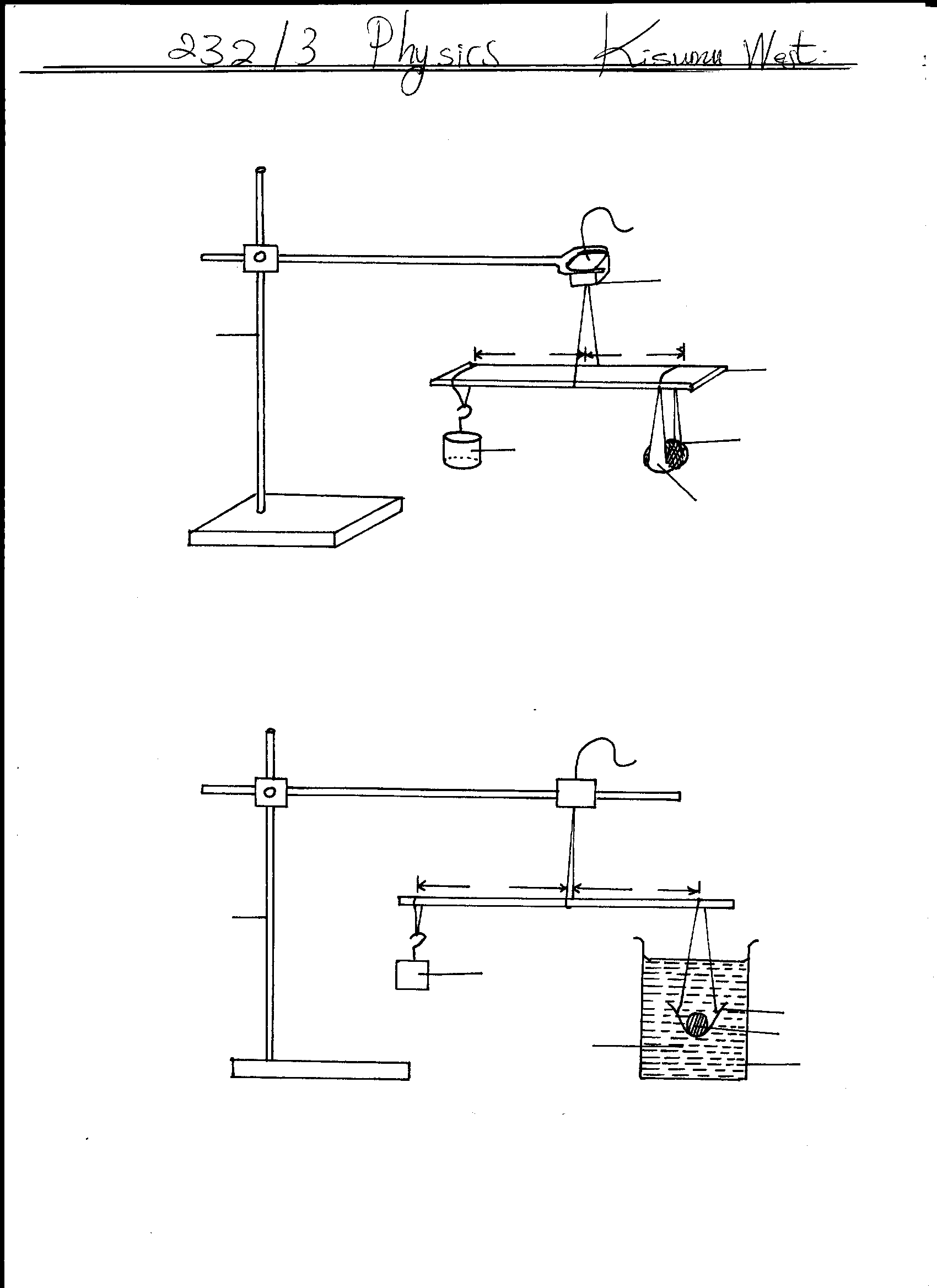
***1. This question consists of two parts A and B attempt both parts***

**PART A**

You are provided with the following:

* two pieces of wooden blocks
* a retort stand, boss and clamp
* a glass marble
* a piece of cotton thread
* a square piece of polythene paper
* a half-metre rule
* a 20 grammes metal mass
* some water
* a 250 ml beaker
* some tissue paper

**Proceed as follows:**

(a) Cut two pieces of cotton thread measuring 60cm and 30cm respectively. Use the threads to make two loops. Suspend the half-metre rule freely at its centre of gravity, **P** using the longer loop.

***Fig. 1(b)***

(b) Suspend the glass marble using threads and the square polythene paper at a distance **X0** = 15cm from the point of suspension, **P**. Also use the shorter thread loop to suspend the 20g metal mass on the opposite side and adjust its position till the half-metre rule is horizontal as in figure 1(a) above. Record the corresponding distance **X1** of the 20g mass from **P**

**X1 =** ……………………………………………….cm (1mk)

(c) Fill the beaker with water up to about three quarters capacity. Maintain the distance **X0** invariant as you immerse the glass marble in water and slide the thread holding the 20g metal mass, till the half-metre rule is horizontal again. Note the new corresponding distance **X2**

(i.e distance between point of suspension of 20g mass and **P**)

X2 = ………………………………………… cm (1mk)

(d) Repeat the procedure in **(b)** and **(c)** for increased values of **X**0 as given in table 1 below.

**NB**:- **After every attempt, wipe the polythene paper and marble dry with the tissue paper provided.**

- **Ensure this experiment is done in a draught free area.**

(e) Complete the table 1 (5mks)

**Table 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Distance of marble in air **X0** (cm) | **15** | **17** | **19** | **21** | **23** | **24.5** |
| Distance of 20g metal mass, **X1** (cm) |  |  |  |  |  |  |
| Distance of 20g metal mass, **X2** (cm)  When marble is in water |  |  |  |  |  |  |
| **X1** - **X2** (cm) |  |  |  |  |  |  |

(f) On the grid provided, plot a graph of **X1** – **X2** (y-axis) against **X1** (5mks)

(g) Determine the slopes, **S** of the graph (3mks)

**PART B**

***You are provided with the following:***

- vernier callipers

- glass marble

**Proceed as follows**

1. Using the vernier callipers, measure the diameter of the glass marble

1st attempt; diameter **D1**= …………………………………cm

2nd attempt (after spinning the glass marble)

Diameter **D2** = ……………………………… cm (1mk)

Determine the value of **D** in the expression:

**D = D1 + D2**

**2**

= …………………………………….cm (1mk)

(i) Find the volume of the glass marble in m3

Volume = ………………………………………………………………. (3mks)

***This question consists of two parts; A and B***

***Attempt both parts and attach the two plain papers used in this question***

**2. PART A**

***You are provided with the following:***

* a soft board
* a white plain paper
* Four (4) optical pins
* a mounted plane mirror labeled **XY**
* Some plasticine (or 4 drawing pins)

**Figure 2(b)**

**Figure 2(a)**

**µ**

***Proceed as follows:***

(a) Use small lumps of plasticine (or drawing pins) to stick the white plain-paper provided onto the soft

board and draw a straight line **MN** on the paper.

- Draw another straight line **M’N’** which intercepts the line **MN** at point **O.**

- The two lines **MN** and **M’N’** make a vertical acute angle of 250 with each other at **O**

- Draw a third line **OT** which makes an angle of 400 with **OM**’. Fix two pins; **P1** and **P2** along the

line **OT. OT** is representing the approaching ray of light. See figure 2(a) (1mk)

(b) Place the plane mirror **XY** lengthwise along line **MN**. Fix pins **P3** and **P4** in line with the images of **P1**

and **P2** as they appear through the mirror.

- Remove the pins **P3** and **P4,** then draw line **OP3P4**.

- Line **OP3P4** is representing the reflected ray of light. (1mk)

(c) (i) Rotate the plane mirror **XY** through the angle of 250 about point **O** such that it lies along the line

**M’N’.**

- Using two pins again, repeat step **(b)** above to obtain the new position of the reflected ray. Label

the marks of the two pins **P5** and **P6** respectively.

- Line **OP5P6** is representing a new position of the reflected ray after rotation.

***See figure 2 (b).***

(ii) Measure the size of a cute angle **µ** between the lines **OP3P4** and **OP5P6**

Angle **µ**  = ………………………………………………………………… (1mk)

**PART B**

***You are provided with the following:***

* a soft board
* a white plain paper
* 4 optical pins
* 4 drawing pins or (some plasticine)
* a mounted plane mirror labelled **XY**

(d) (i) ***Proceed as follows***

Use small lumps of plasticine (or drawing pins) to stick the white plain paper onto the soft board. (Use the second paper provided).

* Draw a straight line **MN**
* Draw another straight line **ON** which is perpendicular to **MN** at **O**. Line **ON** is representing the normal, see **figure 3** above.

Draw a third line **OT** which intercepts **MN** at **O** and makes acute angle **Ө1** = 100 with the normal to the left.

Fix pins **P1** and **P2** onto line **OT**. Line **OT** is representing the approaching ray of light.

Measure the acute angle **Ө1** = 100 between the approaching ray and the normal.

* Place the plane mirror **XY** lengthwise along the line **MN** and observe from the opposite side of the normal to locate the images of **P1** and **P2** as they appear in the mirror
* Fix pins **P3** and **P4** such that they are in line with the images of **P1** and **P2** as they appear in the mirror.

(ii) Remove the mirror, join **P3** and **P4** and produce it to meet at **O** so as to obtain the reflected ray.

Measure angle **Ө2,** the angle between the normal**, PO** and **OP3P4**

Angle **Ө2** = …………………………………………………………………….. (1mk)

1. Repeat step (d) above for the values of **Ө1** given in table 2.

i) Complete table 2

**Table 2** (5mks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Ө1** | 10 | 20 | 30 | 40 | 45 | 55 |
| **Ө2** |  |  |  |  |  |  |
| **Cos** **Ө1** |  |  |  |  |  |  |
| **Cos Ө2** |  |  |  |  |  |  |

(ii) Plot a graph of cos **Ө2**(y-axis) against cos **Ө1**  (5mks)

(iii) Determine the slope **S** of the graph in e(ii) above. (3mks)

(iv) Find the value of F in the expression 27 = F (2mks)

S

1. State the physical law that is verified by the results of question 2 part **B**. (1mk)