END OF YEAR EXAMINATIONS

S.3 PHYSICS PRACTICAL

$\frac{48}{48}$ *OR* $\frac{45}{45}$

TIME: $1\frac{1}{2}$ **hours**

QUESTION ONE (MECHANICS)B

You have applied for a job to work as a purity tester by a company that buys minerals and other substances for use in manufacturing other end products. In order for you to be hired by the managing director, you have to prove that you are knowledgeable in this field and for that reason you have been provided with the materials P, Q, R, and S.

SUPPORT MATERIALS

P **Q** **R** **S**

Given that the density of pure materials are as follows

MATERIAL	P	Q	R	S
DENSITY (gcm^{-3})	1.000	8.571	2.900	0.719

Task

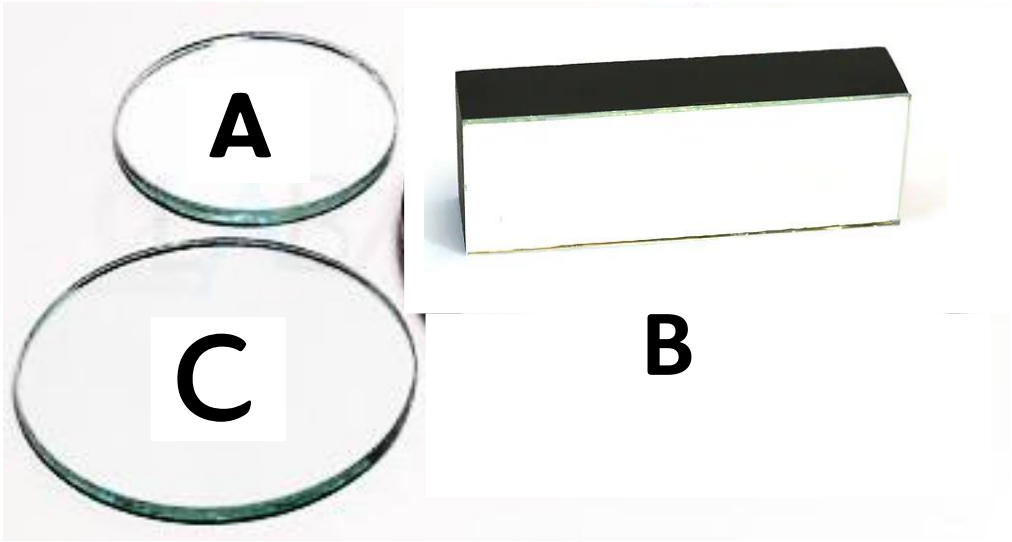
a) you are required to help the company determine the percentage purity of each material. Carry out the experiment and write down the procedures you followed to arrive at the conclusions.

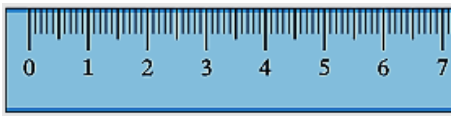
b) Discuss the results obtained and draw a suitable conclusion regarding your scientific investigation in a) above.

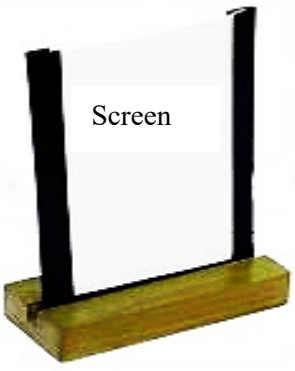
QUESTION TWO (LIGHT)

The school needs curved mirrors to be used by the candidates for their MOCK practical examinations unfortunately your class physics teacher is not available to go and buy them himself. there are rumours that some dealers in curved mirrors sell to schools wrong mirrors most especially when they don't have enough mirrors of your desired focal length. All they want is to sell their products so whenever they don't have enough mirrors you ordered for, they tend to mix with other mirrors of different focal length.

SUPPORT MATERIAL







TASK

a) As a student of physics in charge of school laboratory, carry out the experiment and write down the procedures you followed to arrive at the conclusions (Include ray diagram illustration of the set up used)

b) Discuss the results obtained and draw a suitable conclusion regarding your scientific investigation in a) above.

PROPOSED MARKING GUIDE

SUBSTANCE P (water)

- ✓ I measured the mass of an empty beaker **M_1 = 33.1g**
- ✓ I measured **100 cm³** of substance **P (water)** and poured it into the beaker and then later measured its mass **M_2= 131.4g**
- ✓ I then obtained the mass **M** of substance P(water). **M = M_2 – M_1**
- ✓ M= 131.4 – 33.1
- ✓ M= 98.3 g
- ✓ I then got the density of **P (water)** using. $density = \frac{mass}{volume}$
- ✓ $density = \frac{98.3}{100}$
- ✓ $density = 0.983\ gcm^{-3}$
- ✓ $I\ then\ got\ percentage\ purity\ using\ \frac{density\ calculated}{density\ given} \times 100\%$
- ✓ $\%\ purity = \frac{0.983}{1.000} \times 100\%$
- ✓ $\%\ purity = 98.3\ \%$
- ✓ I conclude that substance **P** has percentage purity of **98.3 %** which means it contains some impurities in it.

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SUBSTANCE Q (steel masses)

- ✓ I placed material **Q** on an electronic balance to note its mass **m=60.8g**
- ✓ I then poured water in the measuring cylinder and noted its initial volume **V_1=50 cm³**
- ✓ I then used a thread to tie material **Q** after which I gently lowered it into the measuring cylinder to obtain the final volume **V_2=58 cm³**
- ✓ I then obtained the **volume V** of material **Q** using **$V=V_2-V_1$**
- ✓ V=58-50 =**8 cm³**
- ✓ I then got the density of Q from $density = \frac{mass}{volume}$
- ✓ $density = \frac{60.8}{8}$

- ✓ $density = 7.600\ gcm^{-3}$
- ✓ $I\ then\ got\ percentage\ purity\ using\ \frac{density\ calculated}{density\ given} \times 100\%$
- ✓ $\%\ purity = \frac{7.600}{8.571} \times 100\%$
- ✓ $\%\ purity = 88.6\ \%$
- ✓ I conclude that substance **Q** has percentage purity of **88.6 %** which means it contains some impurities in it.

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<u>SUBSTANCE R (Stone)</u>

- ✓ I placed material **R** on an electronic balance to note its mass **m=14.6g**
- ✓ I then poured water in the measuring cylinder and noted its initial volume **V_1=51 cm^3**
- ✓ I then used a thread to tie material **R** after which I gently lowered it into the measuring cylinder to obtain the final volume **V_2=57 cm^3**
- ✓ I then obtained the volume V of material **R** using **$V=V_2-V_1$**
- ✓ V=57-51 =**6 cm^3**
- ✓ I then got the density of **R** from $density = \frac{mass}{volume}$
- ✓ $density = \frac{14.6}{6}$
- ✓ $density = 2.433\ gcm^{-3}$
- ✓ $I\ then\ got\ percentage\ purity\ using\ \frac{density\ calculated}{density\ given} \times 100\%$
- ✓ $\%\ purity = \frac{2.433}{2.900} \times 100\%$
- ✓ $\%\ purity = 83.9\ \%$
- ✓ I conclude that substance **R** has percentage purity of **83.9 %** which means it contains some impurities in it.

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<u>SUBSTANCE S (knife edge)</u>

- ✓ I placed material **S** on an electronic balance to note its mass **m=70.5g**
- ✓ I used a metre rule to measure its dimensions as follows.

Dimension	Base (b)	Height (h)	Thickness (t)
Length (cm)	8.4	7.2	3.4

- ✓ I then calculated its volume V using $volume = \frac{1}{2} \times b \times h \times t$
- ✓ $volume = \frac{1}{2} \times 8.4 \times 7.2 \times 3.4$
- ✓ $Volume = \mathbf{102.8\ cm^3}$
- ✓ I then got the density of S from $density = \frac{mass}{volume}$
- ✓ $density = \frac{70.5}{102.8}$
- ✓ $desnity = 0.686\ gcm^{-3}$
- ✓ $I\ then\ got\ percentage\ purity\ using\ \frac{density\ calculated}{density\ given} \times 100\%$
- ✓ $\%\ purity = \frac{0.686}{0.719} \times 100\%$
- ✓ $\%\ purity = 95.4\ \%$
- ✓ I conclude that substance S has percentage purity of **95.4 %** which means it contains some impurities in it.

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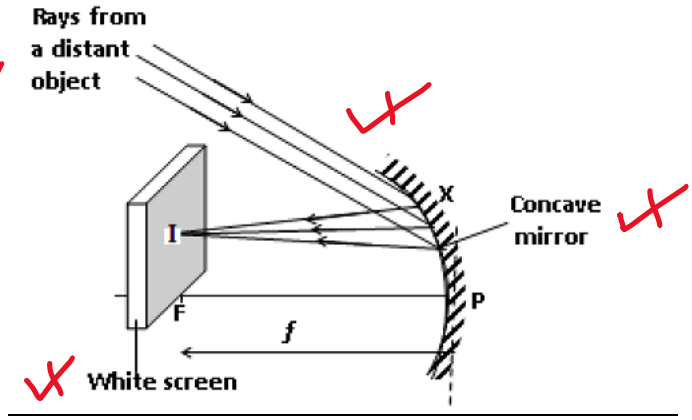
QUESTION TWO (light)

METHOD 1 (Focusing distant object)

(window frame)



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- ✓ The apparatus is set up as shown in the diagram.

- ✓ A concave mirror mounted in a holder is moved **to and fro** in front of the screen until a **sharp image** of the distant object (e.g., window frame) is obtained on the screen.
- ✓ The distance between the screen and the mirror, **f** is measured and recorded. It is focal length of the mirror.
- ✓ The above procedures are repeated about three times and the average focal length.
- ✓ can be obtained as $f = \frac{f_1+f_2+f_3}{3}$
- ✓ **FOR MIRROR A**

Focal length	f_1	f_2	f_3
Value (cm)	15.0	15.0	15.0

- ✓ $f = \frac{f_1+f_2+f_3}{3} = \frac{15.0+15.0+15.0}{3} = 15.0$ cm
- ✓ **FOR MIRROR C**

Focal length	f_1	f_2	f_3
Value (cm)	10.0	10.0	10.0

- ✓ $f = \frac{f_1+f_2+f_3}{3} = \frac{10.0+10.0+10.0}{3} = 10.0\ cm$
- ✓ I hereby conclude that only mirror **B** is not curved, it is a **plane** mirror whereas mirrors **A** and **C** are curved **concave** mirrors of focal lengths 15cm and 10cm respectively.
- ✓ I would select one of the mirrors **A** or **B** for the practical depending on the focal length that the school needs since they are curved.
- ✓ I would not select mirror B since it is a plane mirror and yet the school needs only curved mirrors.

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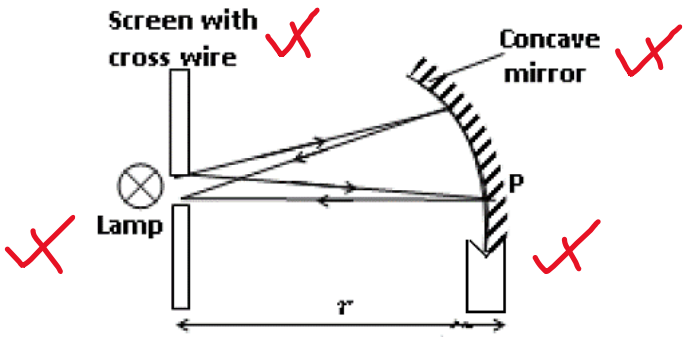
METHOD 2 (Using an illuminated object at C)



- ✓ The apparatus is set up as shown in the diagram.
- ✓ A concave mirror mounted in a holder is moved **to and fro** in front of the screen until a **sharp image** of the cross wire (wire gauze) is obtained on the screen.
- ✓ The distance between the screen and the mirror, r is measured and recorded. It is the radius of curvature, r of the mirror.
- ✓ The above procedures are repeated about three times to obtain the average radius of curvature as $r = \frac{r_{1+r_2+r_3}}{3}$
- ✓ The focal length, f, of the mirror is then determined from.
- ✓ $f = \frac{r}{2}$ where r is the radius of curvature of the mirror

FOR MIRROR A

Radius of curvature	r_1	r_2	r_3
Value (cm)	30.0	30.0	30.0

- ✓ $r = \frac{r_{1+r_2+r_3}}{3} = \frac{30.0+30.0+30.0}{3} = 30.0$ cm
- ✓ $f = \frac{r}{2} = \frac{30.0}{2} = 15.0\ cm.$
- ✓ **FOR MIRROR C**

Radius of curvature	r_1	r_2	r_3
Value (cm)	20.0	20.0	20.0

- ✓ $r = \frac{r_{1+r_2+r_3}}{3} = \frac{20.0+20.0+20.0}{3} = 20.0$ cm
- ✓ $f = \frac{r}{2} = \frac{20.0}{2} = 10.0\ cm$

- ✓ I hereby conclude that only mirror B is not curved, it is a plane mirror whereas mirrors A and C are curved concave mirrors of focal lengths 15cm and 10cm respectively.
- ✓ I would select one of the mirrors A or B for the practical depending on the focal length that the school needs since they are curved.
- ✓ I would not select mirror B since it is a plane mirror and yet the school needs only curved mirrors.

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