

STUDENT EDUCATION NUMBER



## Sāmoa School Certificate

# PHYSICS 2016

## QUESTION and ANSWER BOOKLET

Time allowed: 3 hours & 10 minutes

### INSTRUCTIONS:

1. You have 10 minutes to read **before** you start writing.
2. Write your **Student Education Number (SEN)** in the space provided on the top right hand corner of this page.
3. **ALL Strands are compulsory.** Write your answers in the spaces provided.
4. If you need more space for answers, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number as per exam. Attach the extra sheets at the appropriate places in this booklet.
5. **All required formulas are provided on the last page.**

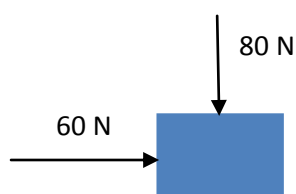
	STRANDS	Page number	Time (minutes)	Weighting
1.	Measurements	2	20	11
2.	Mechanics	4	41	23
3.	Heat	9	24	13
4.	Magnetism	12	27	15
5.	Electricity	15	34	19
6.	Waves	18	34	19
	<b>TOTAL</b>		<b>180</b>	<b>100</b>

**CHECK!** This booklet contains pages 2-23 in the right order.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION**

**STRAND 1****Measurement****Weighting 11**

1. Two forces act on a crate as shown below.



Skill Level 3

- (a) Draw a vector diagram to show the two forces acting on the crate and calculate the resultant force.

Resultant force = \_\_\_\_\_

2. What is the S.I unit for Power?

Skill Level 1

3. Complete the table by identifying which of the following quantities is a vector or scalar quantity.

Quantity	Scalar/Vector
mass	
speed	
displacement	
distance	

Skill Level 2

4. Define the term *vector quantities*.

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Skill Level 1

5. The distances (in metres) travelled by a car at various times (in seconds) are shown below:

Distance (m)	0	8	18	32	50
Time (s)	0	2	3	4	5

In the grid below, draw and label a graph of distance against time.

Skill Level 3

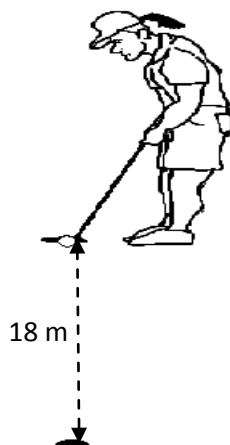
6. The quantity 650 nm (nanometres) expressed in scientific notation is:

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Skill Level 1

**STRAND 2****Mechanics****Weighting 22**

1. Manu is on a golf course practising her putting. He hits a golf ball gently towards the hole, which is 18 metres away and the ball takes 4.5 seconds to reach the hole.



- (a) Show that the average speed of the ball is  $4.0\text{ms}^{-1}$ .  
(Your answer must show the correct formula and working.)

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Skill Level 2

As the golf ball rolls towards the hole, the grass on the green reduces the speed of the ball. The initial speed of the ball is  $6.0\text{ms}^{-1}$  and its average speed is  $4.0\text{ms}^{-1}$ .

- (b) Show that the final speed of the ball just before it reaches the hole is  $2.0\text{ms}^{-1}$ .

(Your answer must show the mathematical working or reasoning.)

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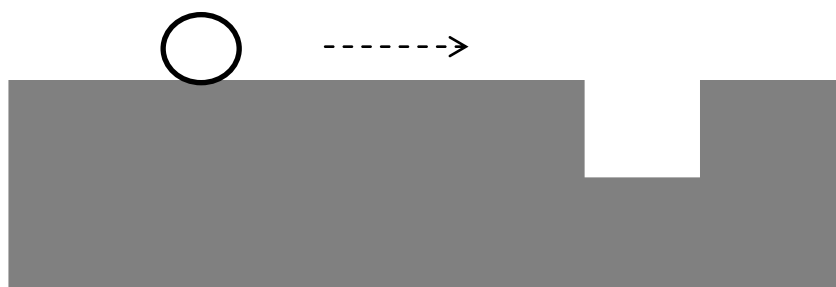
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Skill Level 2

The diagram below shows the ball travelling towards the hole. There are THREE significant forces acting on the ball.

- (c) On the diagram, draw a labelled vector to show the direction of any ONE of these forces acting on the ball during its journey towards the hole.



Skill Level 1

The initial kinetic energy of the ball when it is hit is 0.81 J. the mass of the ball is 0.045 kg and its final velocity is  $2.0\text{ms}^{-1}$ . It travels a distance of 18 m towards the hole.

- (d) Calculate the average friction force exerted by the grass on the ball.

Skill Level 4

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- (e) When the ball is hit, its deceleration depends on the length of the grass on the green.

State how the length of the grass affects the deceleration of the ball

Skill Level 1

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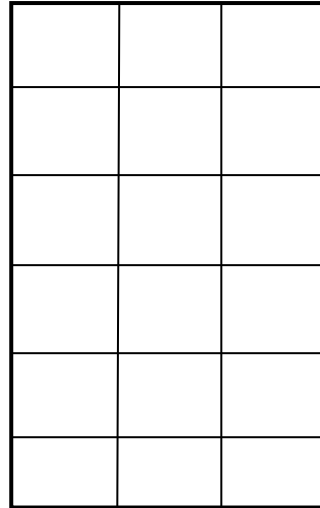
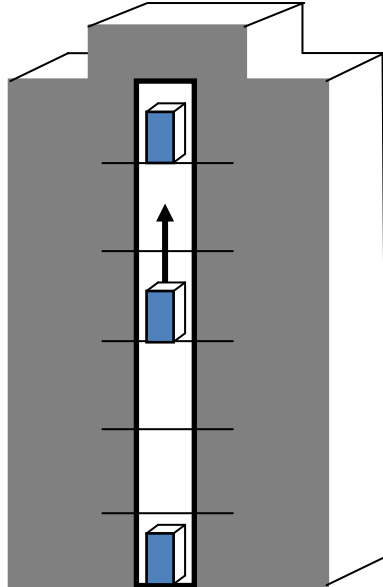


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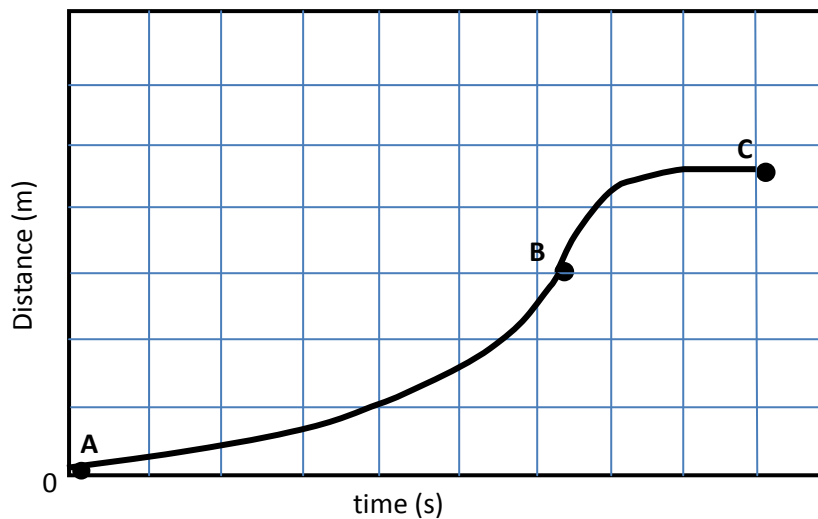
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2. A lift in a multi-storey shopping centre starts from the third floor, travels to the top floor and then to the ground floor. The diagram below shows the lift's journey.



- (a) On the grid above draw a **vector** to show the **displacement** of the lift.

Skill Level 1



- (b) The distance-time graph below represents the journey of the lift from the third floor to the top floor.

Describe the motion in each section of the graph

Section AB:

Skill Level 1

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Section BC

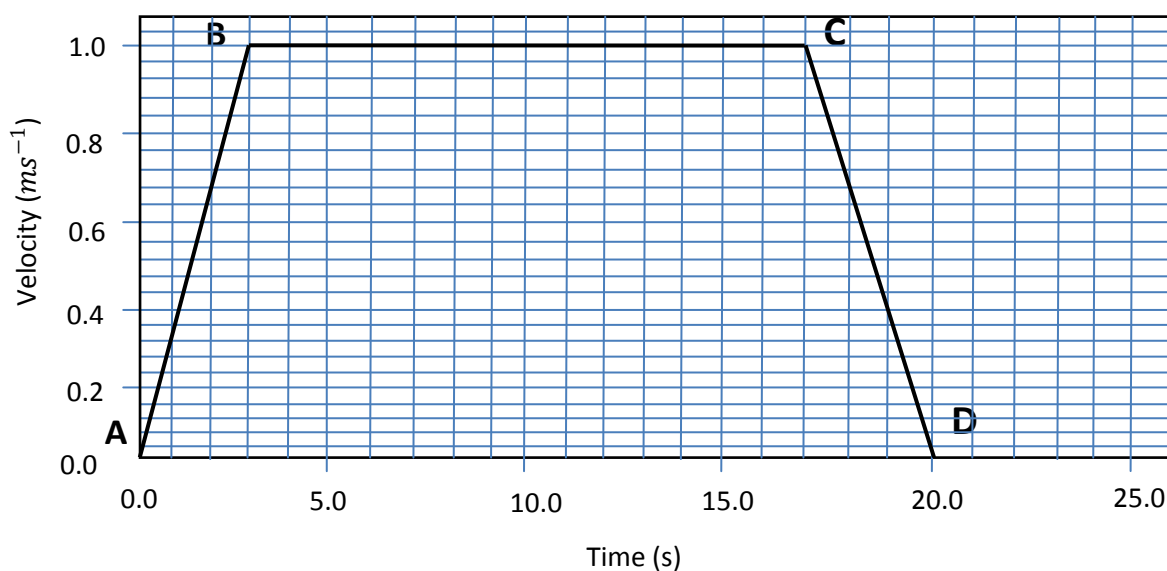
Skill Level 1

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- (c) The velocity-time graph below represents the journey of the lift as it travels from the top floor to the ground floor. The mass of the lift is 310 kg.



Use the information given in the graph to answer the following.

- (i) Calculate the total distance travelled by the lift.

Skill Level 3

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- (ii) Calculate the amount of gravitational potential energy lost by the lift as it travels from the top floor to the ground floor.

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Skill Level 3
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- (iii) State the value of acceleration in the following sections of the graph.

Section AB: \_\_\_\_\_

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Skill Level 1
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Section BC: \_\_\_\_\_

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Skill Level 1
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Section CD: \_\_\_\_\_

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Skill Level 1
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3. State **ONE** factor that affects the amount of potential energy an object possess.

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Skill Level 1
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**STRAND 3****Heat****Weighting 13**

1. There are three types of heat transfer methods. Which one that does NOT need a medium to travel through?

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Skill Level 1

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2. When Sonya sits in a chair, she notices that the metal frame feels colder than the fabric of the chair, even though the metal and fabric are at the same temperature.

State the reason why for this difference.

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Skill Level 2

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3. State what is meant by the term *temperature*.

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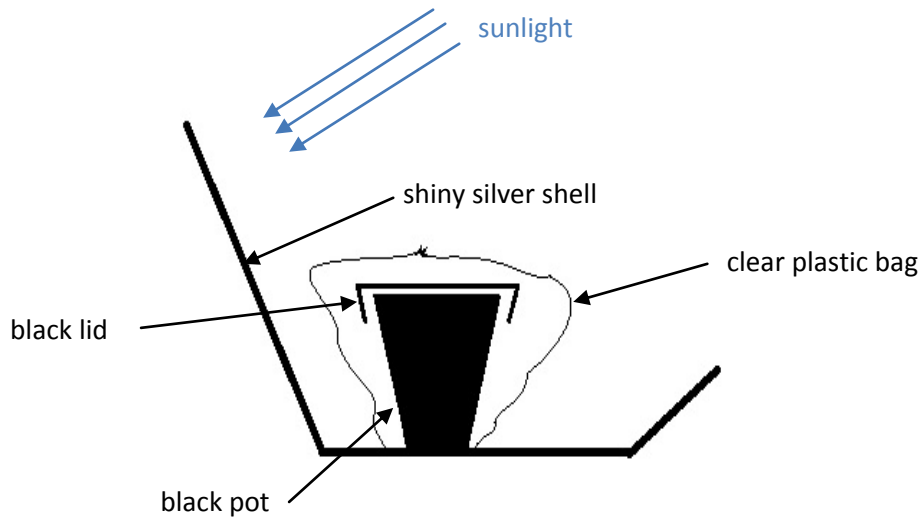
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Skill Level 1

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4. The diagram below shows a side view of a solar cooker being used to heat food. It consists of an L-shaped shell with a silver interior wall. There is a platform in the middle for a cooking pot. A black cooking pot with a lid will be placed inside a closed clear plastic bag.



The main features of the cooker are:

- The shiny interior wall of the cooker
- The black surface of the pot
- The L-shaped reflector shell

- a) Explain how these features help heat the food efficiently.

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Skill Level 4

5. 100g of water at  $23^{\circ}\text{C}$  is poured into the solar cooker's pot and left in the sun without the lid for 20 minutes. Two minutes later, the temperature of the water is  $42^{\circ}\text{C}$ .

Calculate the amount of **heat energy** gained by the water.

Skill Level 3

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6. Covert the following:

a)  $40^{\circ}\text{C}$  to kelvins

Skill Level 1

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b) 300 K to  $^{\circ}\text{C}$

Skill Level 1

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**STRAND 4****Magnetism****Weighting 16**

1. State the law of magnetism.

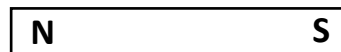
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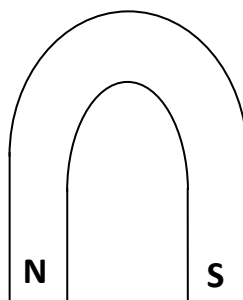
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Skill Level 1

2. Draw and label magnetic fields around the given magnets below.



Skill Level 2



3. Permanent magnets are those which can be made using various methods. Identify and describe **ONE** of these methods of making permanent magnets.

Method: \_\_\_\_\_

Skill Level 2

Description: \_\_\_\_\_

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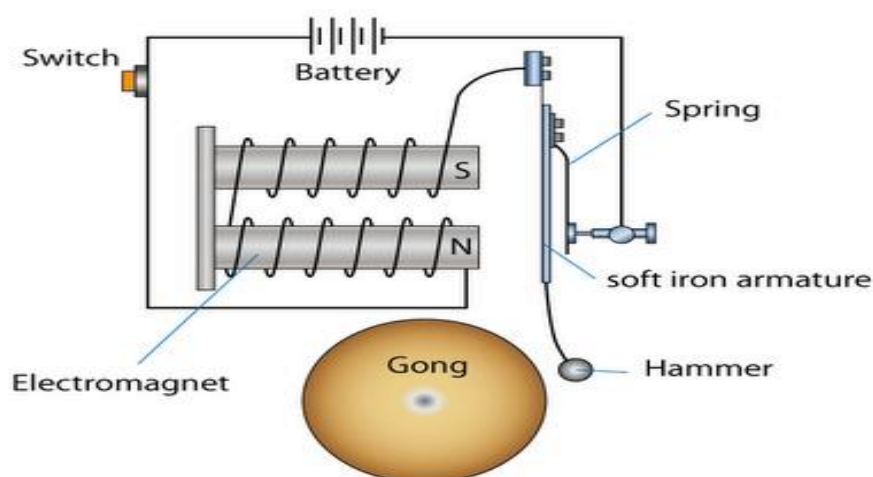


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4. Given below is a diagram of an electric bell.



Skill Level 4

When someone pushes the switch button clearly explain in detail the practical application and working principle of this electric bell

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5. Explain why like poles repel and unlike poles attract.

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Skill Level 3

6. Identify any precaution to prevent magnets from being de-magnetised.

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Skill Level 1

7. State ONE way on how to increase the strength of an electromagnet.

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Skill Level 1

8. Give ONE example of an electromagnet.

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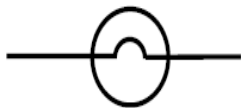
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Skill Level 1

**STRAND 5****Electricity****Weighting 19**

1. Identify the correct name for the following symbol.



Skill Level 1

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2. Define the term *resistance* and include its S.I unit.

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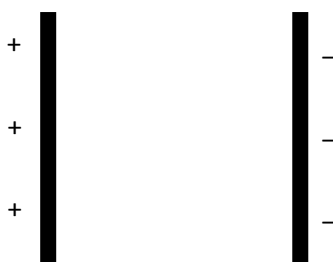
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Skill Level 1

3. Draw electric fields between the pair of parallel plates below and discuss the shape and direction of these electric fields.



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Skill Level 3

4. List TWO examples of electrostatic as used in everyday life.

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Skill Level 2

5. State the formulae for Power in terms of Voltage and Current

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Skill Level 1

6. A resistor of  $10\ \Omega$  is connected in series with two other resistors ( $6\ \Omega$  and  $30\ \Omega$ ) that are in parallel together with a battery of EMF  $12\ \text{V}$  and a current of  $3\ \text{A}$  flows from the battery.

- (a) In the space below, demonstrate, using your knowledge of circuitry by drawing a labelled diagram of the circuit explained above with all its components.

Skill Level 4

- (b) Calculate the total resistance for the circuit in (a).

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Skill Level 3



(c) Find the total current through the circuit in (a)

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Skill Level 2

7. What is an electric field?

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Skill Level 1

8. State ONE factor affecting the resistance of any circuit.

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Skill Level 1

**STRAND 6****Waves****Weighting 19**

1. Light is known to have a rectilinear propagation property. Clearly define what it means by 'rectilinear propagation'.

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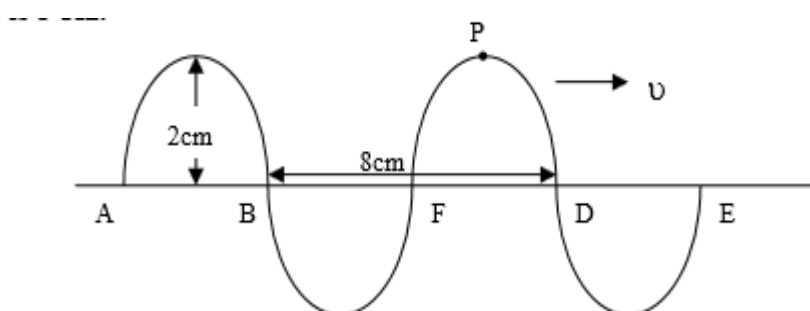
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Skill Level 1

2. The diagram below shows a transverse wave moving towards the right. The frequency of the waves is 3 Hz.



- (a) Determine the speed of the wave using the wave equation.

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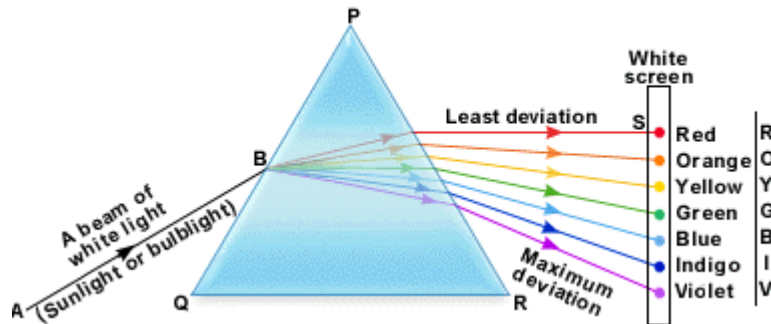
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Skill Level 3

3. When white light passes through a prism, it splits up into the seven colours of a rainbow.

Using your knowledge of dispersion of white light by prisms, clearly explain how rainbows are formed.




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Skill Level 3

4. What does it mean by the phrase 'lateral inversion'?

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Skill Level 1

5. The formula  $v = \frac{\lambda}{T}$  describes the speed of a water wave in terms of its wavelength and period.

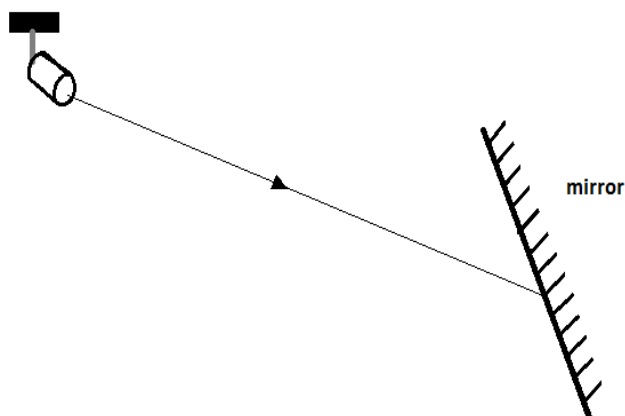
Which of the 3 quantities (  $v, \lambda, T$  ) **does not change** as the wave travels from deep to shallow region?

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Skill Level 1

6. A display mirror is mounted on a sloped surface in a shop. Light from a lamp in the ceiling is incident on the mirror, as shown in the diagram below.



Skill Level 2

(a) Using the above diagram:

- Draw a normal at the point of incidence, and then draw an arrow to show the approximate path of the reflected ray.
- Label the angle of incidence and the angle of reflection.

- (b) How does the angle between the incident ray and the mirror compare with the angle between the reflected ray and the mirror? (Give a reason for your answer)

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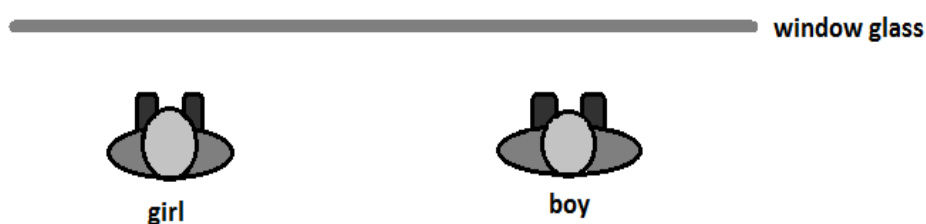
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Skill Level 2
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- (c) A girl and a boy are looking into the shop through a large glass window, as shown below. They both see their own image in the window glass.



On the above diagram, demonstrate your understanding of reflection and rectilinear propagation of light by:

- (i) using the letter 'X' to mark the position of the **girl's** image as seen by the **boy**.
- (ii) drawing **TWO** rays to show why the boy sees the girl's image in the position you have marked X.

Skill Level 4
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7. When the image of an object is smaller than the object itself, what does it tell us about its magnification value?

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Skill Level 1

8. Name ONE example of a longitudinal wave.

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Skill Level 1

## PHYSICS EQUATIONS SHEET

### Kinematics

$$v = u + at$$

$$d = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2ad$$

$$v = \frac{\Delta d}{\Delta t}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$F = ma$$

### Electricity and Magnetism

$$P = \frac{W}{t}$$

$$I = \frac{Q}{t}$$

$$V = IR$$

$$P = VI$$

$$B = \frac{kI}{d}$$

$$F = Bqv$$

$$V = Bvl$$

### List of constants

$$g = 10 \frac{m}{s^2}$$

$$k = 2 \times 10^{-7} NA^{-2}$$

$$m_e = 9 \times 10^{-31} kg$$

$$G = 6.67 \times 10^{-11} Nm^2 / kg^2$$

$$k = 9.0 \times 10^9 Nm^2 C^{-2}$$

### Heat

$$Q = mc\Delta T$$

$$c = 4200 J/kgK$$

### Energy and Mechanics

$$W = Fd$$

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

$$P = F/A$$

$$P = W/t$$

### Light and Waves

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$m = \frac{H_i}{H_o} = \frac{d_i}{d_o}$$

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

$$T = \frac{1}{f}$$

$$v = f\lambda$$