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90254

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 2 Physics, 2005

90254 Demonstrate understanding of waves

Credits: Four
2.00 pm Tuesday 29 November 2005

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

For all numerical answers, full working must be shown. The answer should be given with an SI unit.

For all 'describe' or 'explain' questions, the answer should be in complete sentences.

Formulae you may find useful are given on page 2.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–9 in the correct order and that none of these pages is blank.

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

For Assessor's use only	**Achievement Criteria**				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Identify or describe aspects of phenomena, concepts or principles.		Give descriptions or explanations in terms of phenomena, concepts, principles and/or relationships.		Give concise explanations, that show clear understanding, in terms of phenomena, concepts, principles and/or relationships.	
Solve straightforward problems.		Solve problems.		Solve complex problems.	
Overall Level of Performance					

You are advised to spend 40 minutes answering the questions in this booklet.

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You may find the following formulae useful.

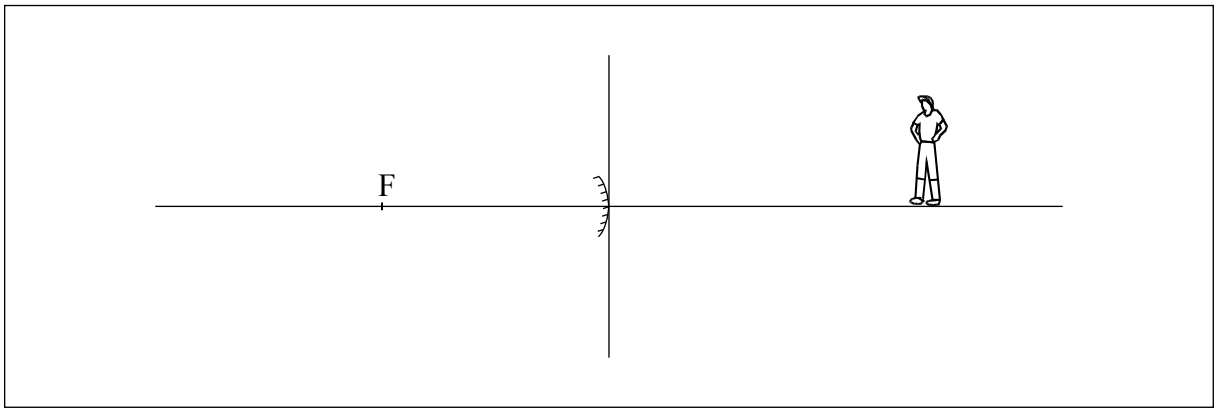
$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ or $s_i s_o = f^2$ $\quad m = \frac{d_i}{d_o} = \frac{h_i}{h_o}$ or $m = \frac{f}{s_o} = \frac{s_i}{f}$

$n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\quad \frac{n_1}{n_2} = \frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$ $\quad v = f\lambda$ $\quad f = \frac{1}{T}$

QUESTION ONE

Robbie and Amy are visiting the new aquatic centre in town. When Robbie is at the counter he looks at the security mirror on the wall. He notices that the mirror is curved, and it bends outwards in the middle.

(a) On the diagram below, draw appropriate **rays** to show how his **image** is formed.



(b) Calculate the magnification **using your diagram**.

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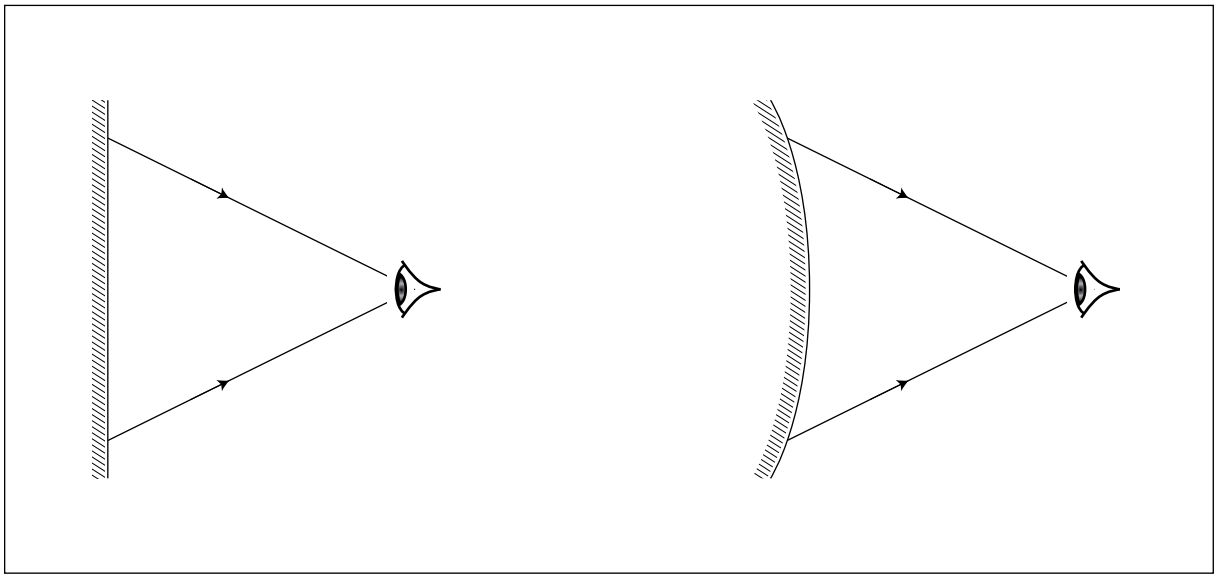
(c) Robbie moves so he is standing 3.0 m away from the pole of the mirror. The mirror's radius of curvature is 2.0 m. Calculate the distance between Robbie and his image.

(d) The diagrams below represent rays of light reflected from near the ends of a plane mirror and the security mirror into Robbie's eye. Draw normals and incident rays, and use them to explain the **advantage** of using a convex mirror.



QUESTION TWO

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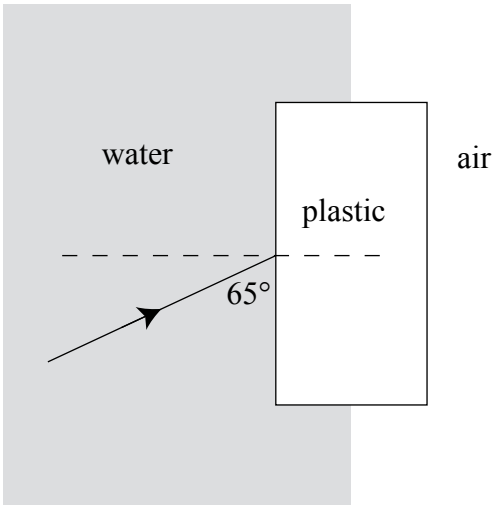
Robbie and Amy decide to practise their underwater swimming. They are both wearing swimming goggles.

(a) The diagram below shows a ray of light entering the transparent plastic goggles. Continue the ray showing how it bends as it enters the plastic, **and** then as it enters the air.
(The plastic is optically denser than water.)



(b) The ray of light deviates (or changes direction) through an angle of 4.0^{o} as it enters the plastic. The refractive index of plastic is 1.5.

Calculate the refractive index of the water.

(c) State the meaning of the term "absolute refractive index".

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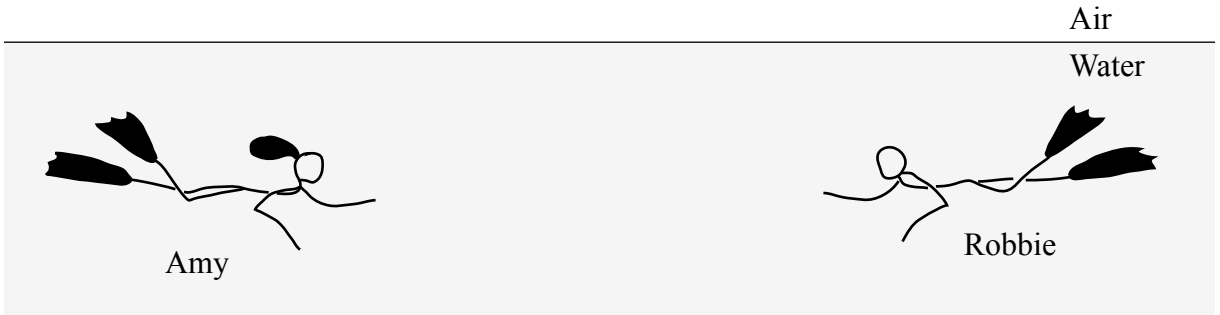
(d) State the meaning of the term "critical angle".

(e) Calculate the critical angle for the plastic/air interface.

(f) A short time later, Robbie and Amy are in the pool, swimming under water. Amy notices that when she looks forwards, she can see Robbie, but she can also see a reflected image of him.

Draw TWO rays to show how Robbie's image is formed. Draw Robbie's **reflected image** in the correct place.



QUESTION THREE

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Robbie is sitting beside the outside pool listening to music. His radio receives radio waves and produces sound waves. ($v_{light} = 3.0 \times 10^8$ ms^{-1})

The dial shows that he is tuned to 91.0 MHz.

(a) State ONE important **difference** between radio waves and sound waves.

(b) The radio wave is produced by making electrons oscillate up and down inside an aerial. Calculate how long it will take one of the electrons to oscillate up and down **once**.

(c) Calculate the **wavelength** of the radio wave. Write your answer to the correct number of significant figures.

(d) The radio's speaker cone causes the air molecules to vibrate. Each molecule moves a **total** distance of 1.0 cm every oscillation. Calculate the amplitude of an oscillation.

QUESTION FOUR

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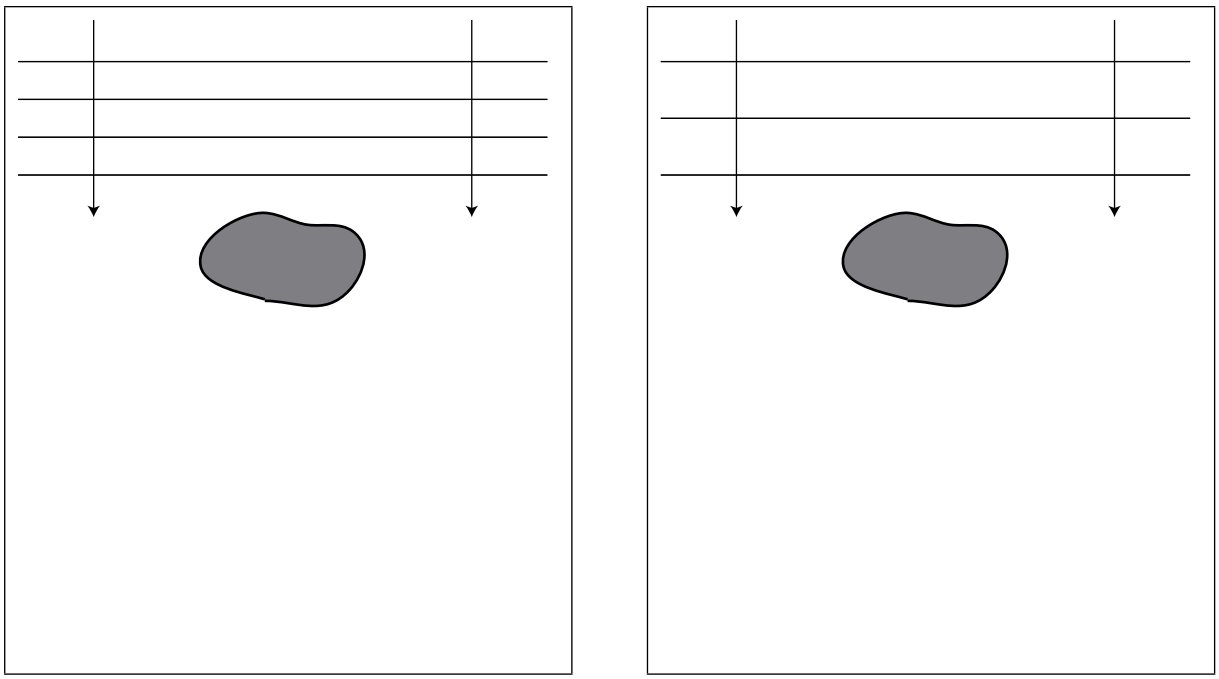
Robbie and Amy are sitting beside the children's pool. The children's pool has an island in it. Waves travel past the island as shown in the diagrams below. Robbie looks at the shape of the waves after they pass the island. He notices that the wave behaviour depends on the wavelength.

(a) Draw the wave patterns he would observe as the waves pass the island in each case.



(b) State the name of this phenomenon.

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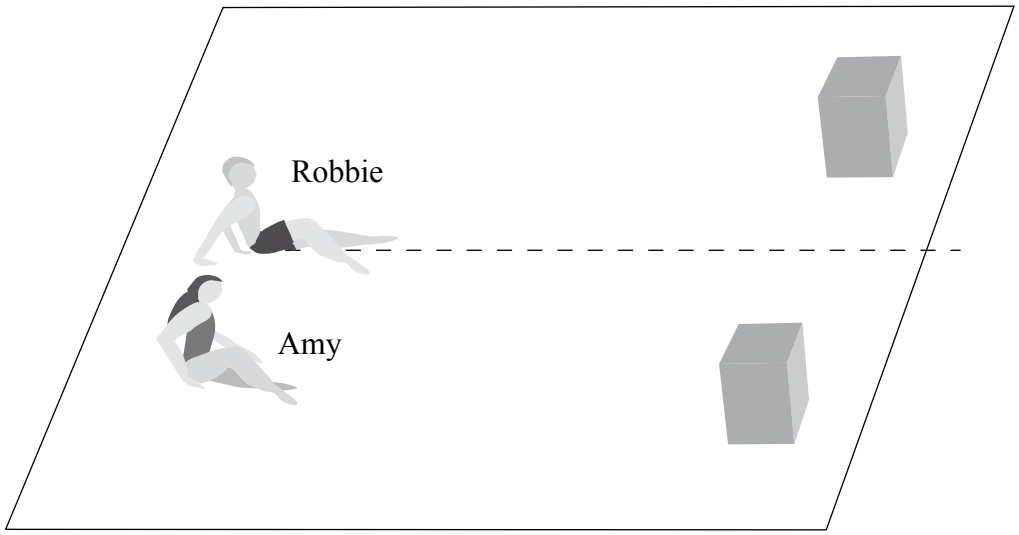
(c) There are two speakers on the grass area by the pool. The speakers are producing the same constant frequency sound. Robbie and Amy are sitting facing them as shown. Robbie complains that the sound is loud but Amy observes it to be quiet. Explain clearly how **interference** could cause this to happen.



Extra paper for continuation of answers if required.
Clearly number the question.

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Question number	