

# Reflection, Diffraction & Doppler Effect

## Question Paper 2

<b>Level</b>	International A Level
<b>Subject</b>	Physics
<b>Exam Board</b>	Edexcel
<b>Topic</b>	Waves
<b>Sub Topic</b>	Reflection, Diffraction & Doppler Effect
<b>Booklet</b>	Question Paper 2

**Time Allowed:** 44 minutes

**Score:** /36

**Percentage:** /100

**Grade Boundaries:**

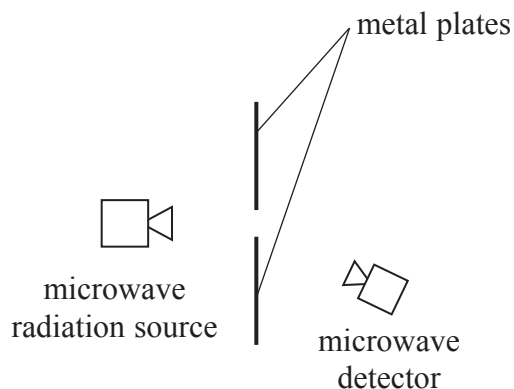
A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 A student investigates diffraction.

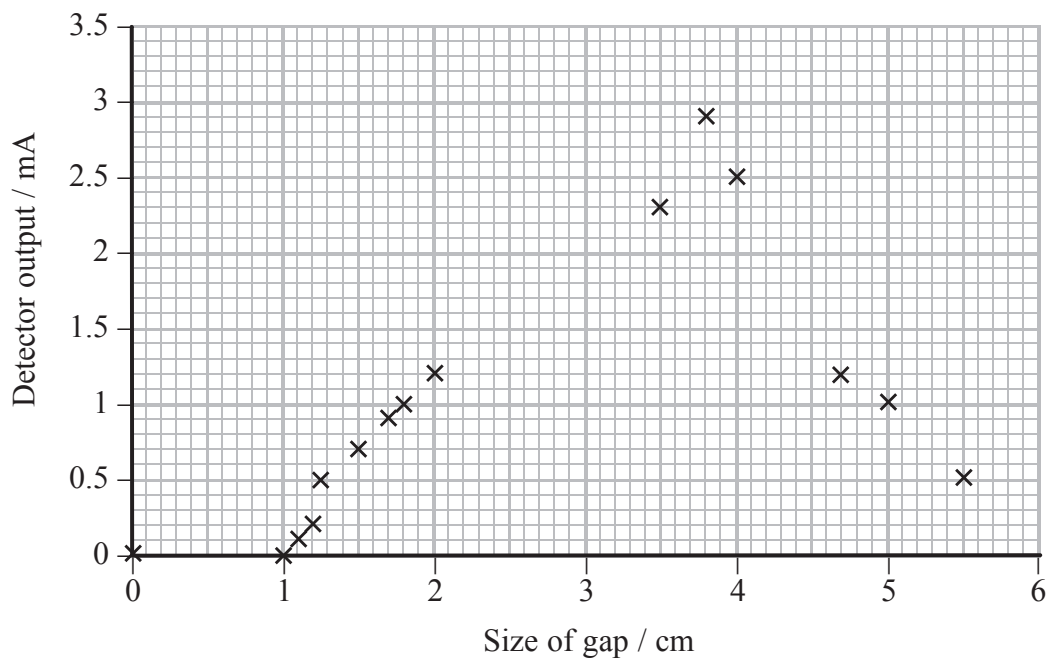
(a) Draw a diagram to illustrate what is meant by diffraction.

(2)

(b) The student directs microwave radiation at the gap between two metal plates, as shown below.



The microwave radiation source and detector are left in the same positions while the size of the gap between the metal plates is varied. The output of the detector and size of the gap are measured. The graph shows the results.





2 It is often difficult to see below the surface of a pond because of glare. This is when the intensity of light from the sky reflected from the surface is much greater than that of light from below the surface.

Sunglasses with polarising lenses can reduce the effect of glare, allowing the observer to see clearly what is below the surface of the water. This is because light from the sky becomes plane polarised when it is reflected.

(a) Explain the difference between plane polarised and unpolarised light.

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(b) Explain how a polarising lens may be used to remove the glare but still allow light from below the surface of the pond to reach the observer.

(3)

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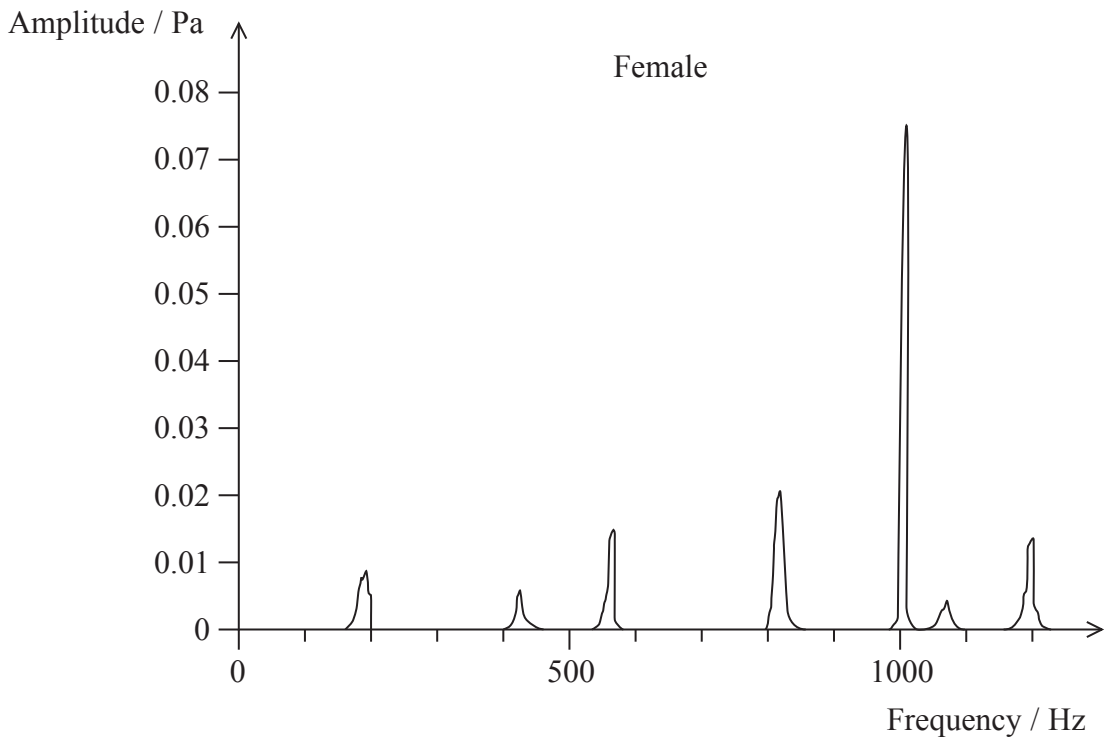
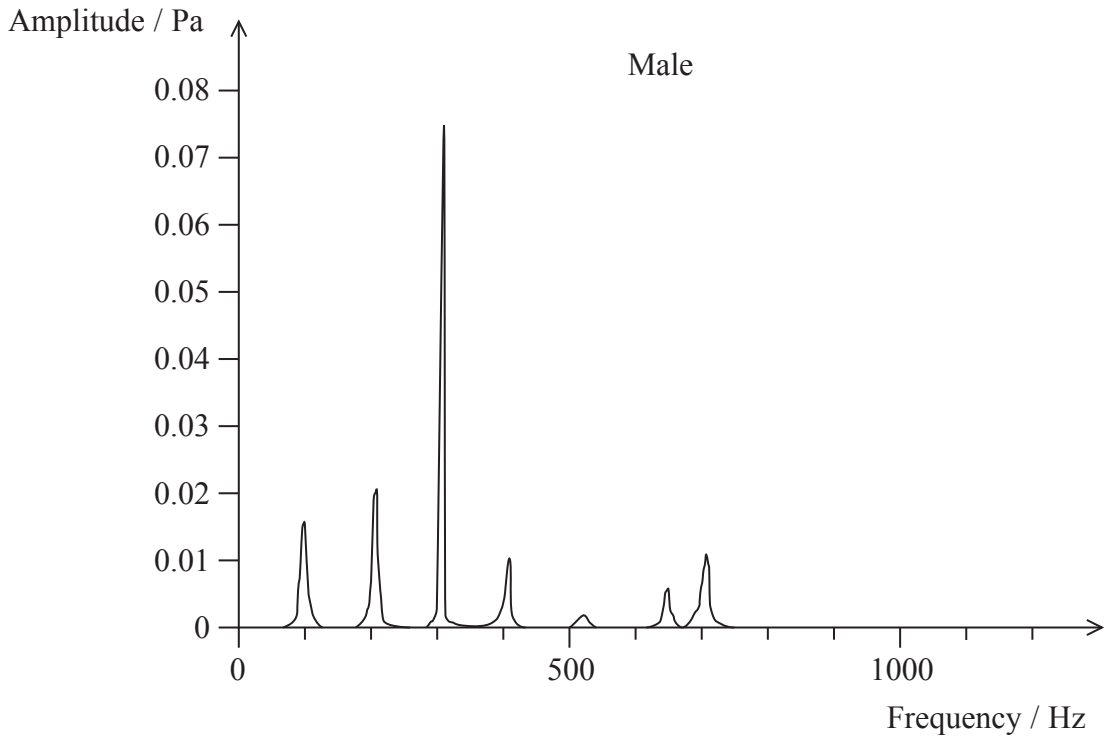
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**(Total for Question 2 = 6 marks)**

3 The following frequency spectra are for a female and a male voice saying “how”.



(a) The peak wavelength for the male is about 1 m.

Show that the peak wavelength for the female is about 0.3 m.

speed of sound in air =  $330 \text{ m s}^{-1}$

(3)

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(b) It is possible to hear someone talking from the other side of an open door because of diffraction, even when they are not in the line of sight.

(i) Describe what is meant by diffraction.

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(ii) It is suggested that a male voice may be heard in this way more effectively than a female voice.

Comment on this suggestion for a doorway of width 90 cm.

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**(Total for Question 3 = 7 marks)**

4 A washing machine produces large vibrations during its spin cycle.  
A student decides to use the vibrations from the washing machine to produce ripples in a ripple tank and hence determine the frequency at which the washing machine spins.

(a) The student must first determine the speed of a ripple in the tank. She disturbs the surface of the water to produce a single ripple. She uses a stopwatch to measure the time taken for the ripple to travel a distance of 15 cm and records a time of 0.72 s.

Explain an alternative method that she could use to measure the time and why this method would be an improvement.

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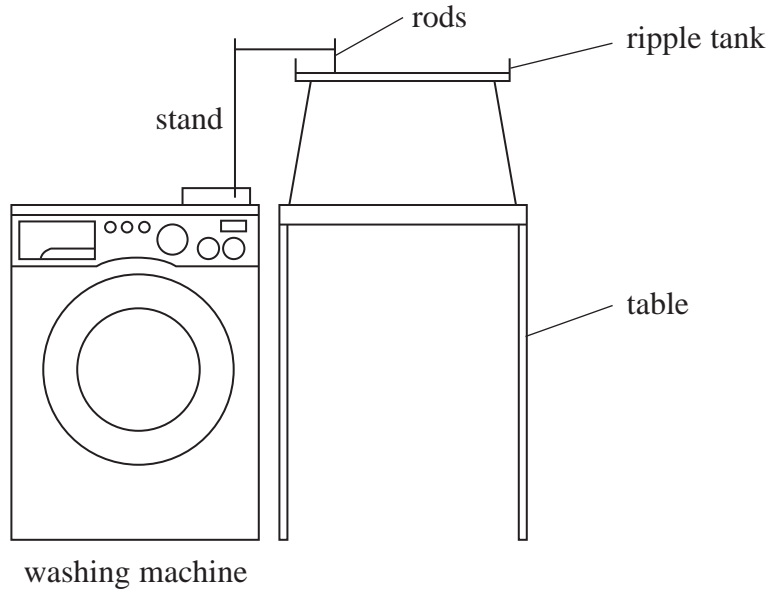
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- (b) A bar is attached to a stand on top of the washing machine so that it vibrates at the same frequency as the machine. Two small rods are attached to the bar so that they just dip into the water in the ripple tank and act as a pair of coherent sources.



Explain why the rods are said to act as coherent sources.

(2)

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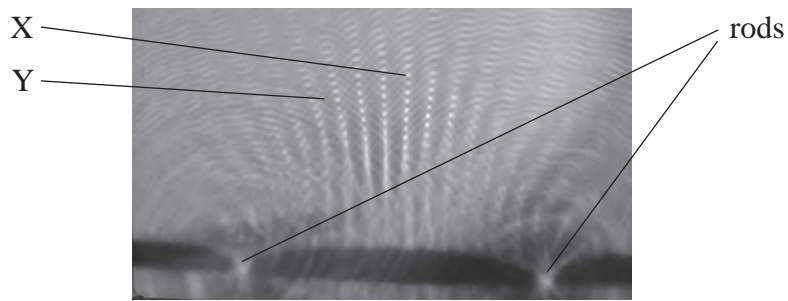
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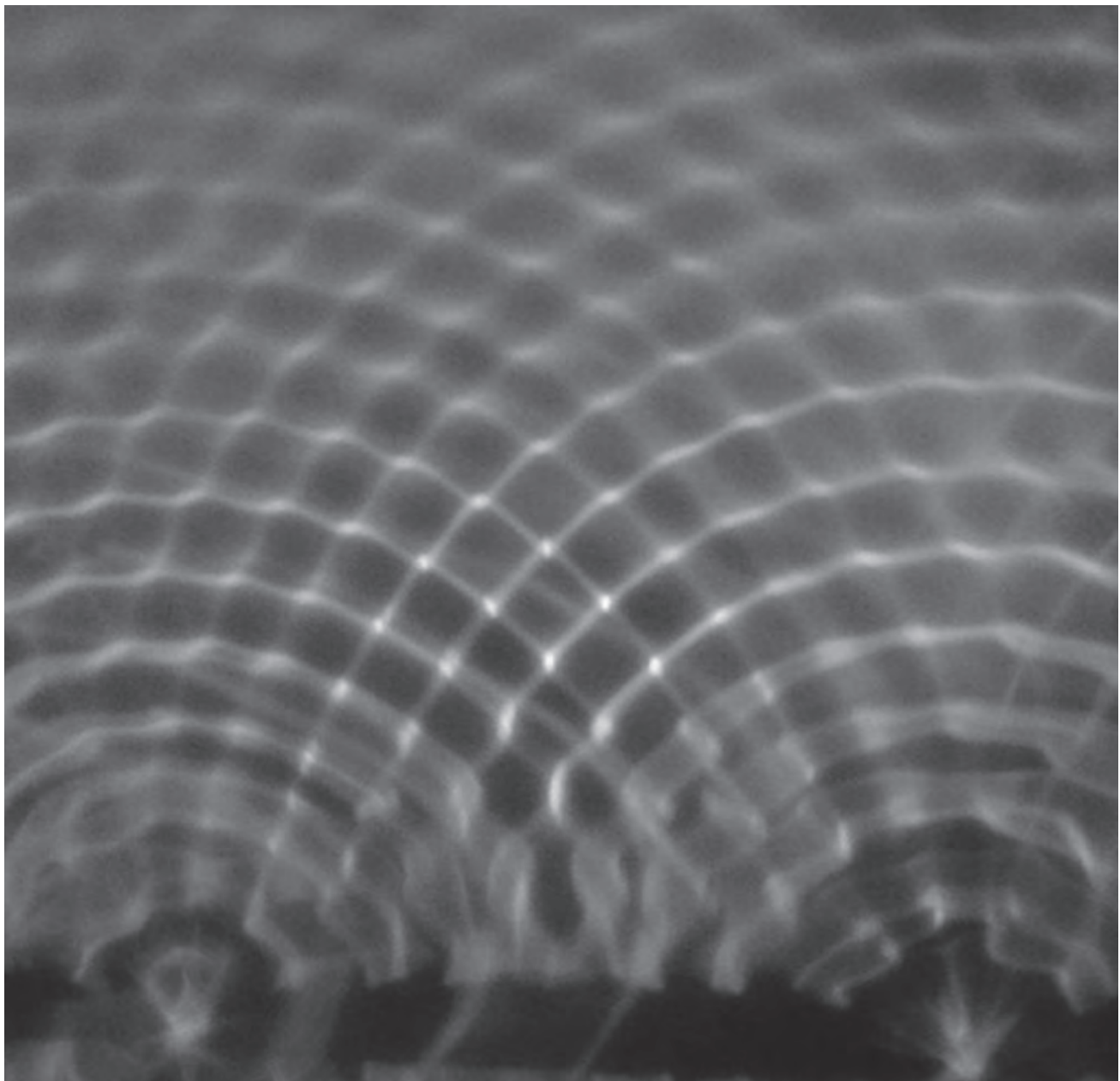
(c) Photograph 1 shows the pattern observed when the washing machine spins.



Photograph 1

X shows a line along which maximum disturbance is seen. Y shows a region in which there is almost no disturbance.

Photograph 2 was taken using a flash to show the individual waves from the two rods at a single instant. Photograph 2 is shown actual size.



\***(i)** Explain how the interference pattern in photograph 1 is produced.

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**(ii)** Use measurements from photograph 2 to determine the frequency of the vibration causing the ripples.

speed of ripples =  $25.2 \text{ cm s}^{-1}$

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Frequency of vibration = .....

**(Total for Question 4 = 15 marks)**

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