TWENTY FIRST CENTURY
science

Module P6

THE WAVE MODEL OF RADIATION

Practice test

FOUNDATION

Name: .....

Form/teaching set: .....

Answer all of the questions.

Write your answers in the spaces provided on this paper.

Useful relationships

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

momentum = mass $\times$ velocity

change in momentum = resultant force $\times$ time for which it acts

work done by force = force $\times$ distance moved by force

change in energy = work done

change in GPE = weight $\times$ vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times (\text{velocity})^2$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage in primary coil}}{\text{voltage in secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

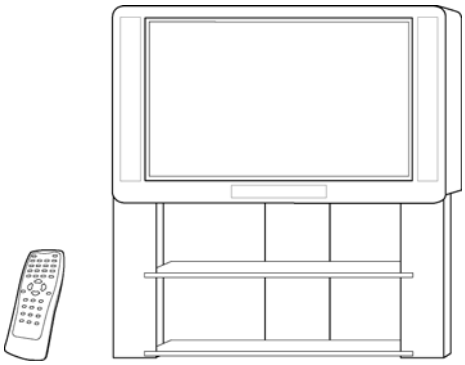
power = potential difference $\times$ current

energy transferred = power $\times$ time

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}}$$

wave speed = frequency $\times$ wavelength

1



To do its job, the television uses electromagnetic radiation.

(a) Complete the diagram of the electromagnetic spectrum.

Use words from the list.

gamma **microwave** **ultraviolet** **X-ray**

			visible light	infrared		radio

[3]

(b) The television uses three types of electromagnetic radiation.

Complete the table to show which types of radiation are used for each job.

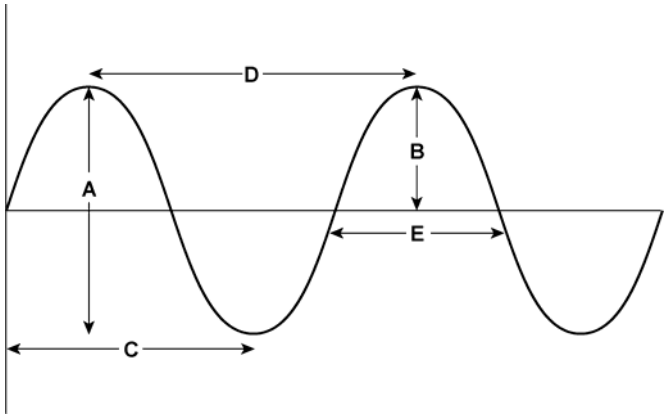
use by TV	**type of electromagnetic radiation**
aerial receives signals from the transmitter	
sends picture to person watching TV	
sends signals from remote control to TV	

[3]

[Total marks: 6]

2

(a) This is a diagram of a water wave.

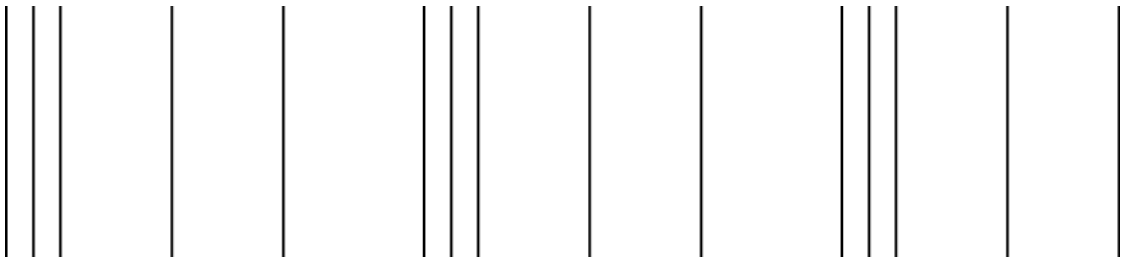


(i) Which letter shows the **amplitude** of the wave? ..... [1]

(ii) Which letter shows the **wavelength** of the wave? ..... [1]

(b) Sound waves are different.

On the diagram of a sound wave below, draw an arrow ↔ to show one wavelength.



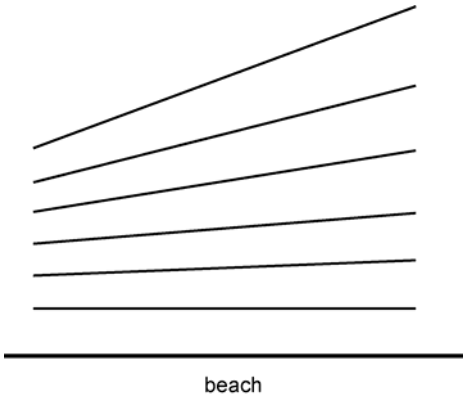
[1]

(c) In a sound wave, the particles vibrate in the same direction as the wave is moving.

What is the name for this type of wave? ..... [1]

[Total marks: 4]

3 Jo is watching waves coming into the beach.



(a) As the waves approach the beach they are refracted towards the beach.

What is changing about the waves that causes this refraction?

Put a (ring) around the correct answer.

amplitude **diffraction** **frequency** **interference** **wave speed**

[1]

(b) Jo decides to work out the speed of the waves.

Jo estimates the wavelength at 4 metres and the frequency at 2 hertz.

Calculate the speed of the waves.

wave speed = ... units .....

[3]

[Total marks: 4]

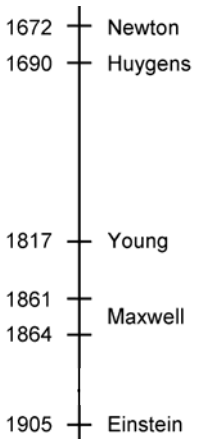
4 Discovering Light

Many scientists have contributed to our knowledge of light.

In 1672, Newton showed that white light was made up of many colours. Newton suggested that light was made of particles.

In 1690, Christiaan Huygens described light as a wave and explained diffraction and interference of light. Thomas Young showed that light was a wave in 1817.

In 1864, James Clark Maxwell showed that light was an electromagnetic wave.



In 1905, Albert Einstein explained the photoelectric effect by suggesting that light was made up of photons.

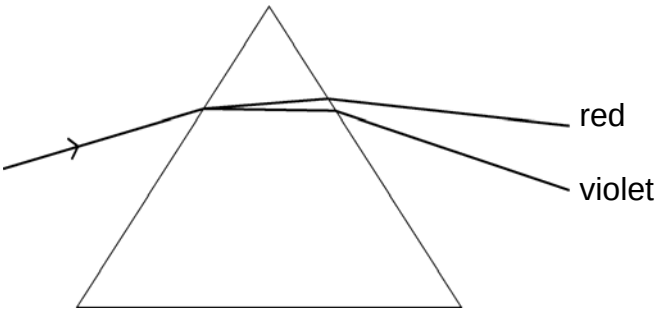
(a) (i) Newton used a glass prism to split white light into the different colours of the rainbow.

What is the scientific name for the rainbow he made?

..... [1]

(ii) The diagram shows Newton's experiment.

The colours at each end of his 'rainbow' are labelled.



Which of the following statements correctly explains why violet light refracts more in glass than red light ?

Put ticks (✓) in the **two** correct boxes.

Red and violet light have different speeds in air.	☐
Red and violet light have different speeds in glass.	☐
Red and violet light have different amplitudes in glass.	☐
Red and violet light have different frequencies in glass.	☐
Red and violet light have different wavelengths in glass.	☐

[2]

(b) James Clark Maxwell said light was an electromagnetic wave in 1864.

Write down two ways in which electromagnetic waves are different from sound waves.

1 ……

……

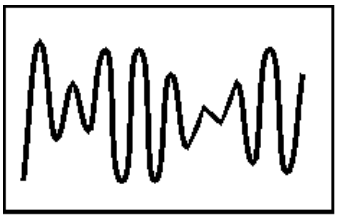
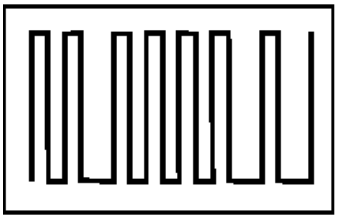
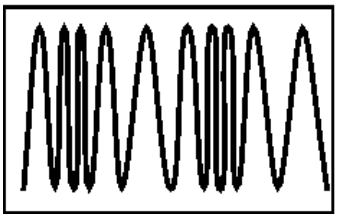
2 ……

…… [2]

[Total marks: 6]

5 The diagrams below show different signals together with their descriptions.

Using straight lines, join each signal to its correct description.

signal	**description**
	digital signal
	frequency modulated signal
	amplitude modulated signal

[1]

[Total marks for the test: 20]

TWENTY FIRST CENTURY
science

Module P6

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HIGHER

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Form/teaching set: .....

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Write your answers in the spaces provided on this paper.

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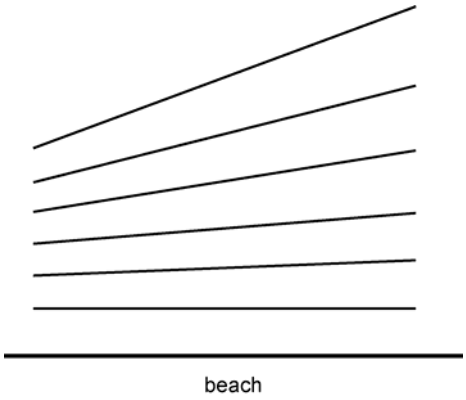
1 Jo is watching waves coming into the beach.



(a) As the waves approach the beach, they are refracted towards the beach.

What is changing about the waves that causes this refraction?

Put a (ring) around the correct answer.

amplitude **diffraction** **frequency** **interference** **wave speed** [1]

(b) Jo decides to work out the speed of the waves.

(i) Jo measures the frequency of the waves.

It takes 250 seconds for 10 waves to reach the beach..

What is the frequency of the waves?

Put a (ring) around the correct answer.

0.02 Hz **0.04 Hz** **2.5 Hz** **4 Hz** **25 Hz** [1]

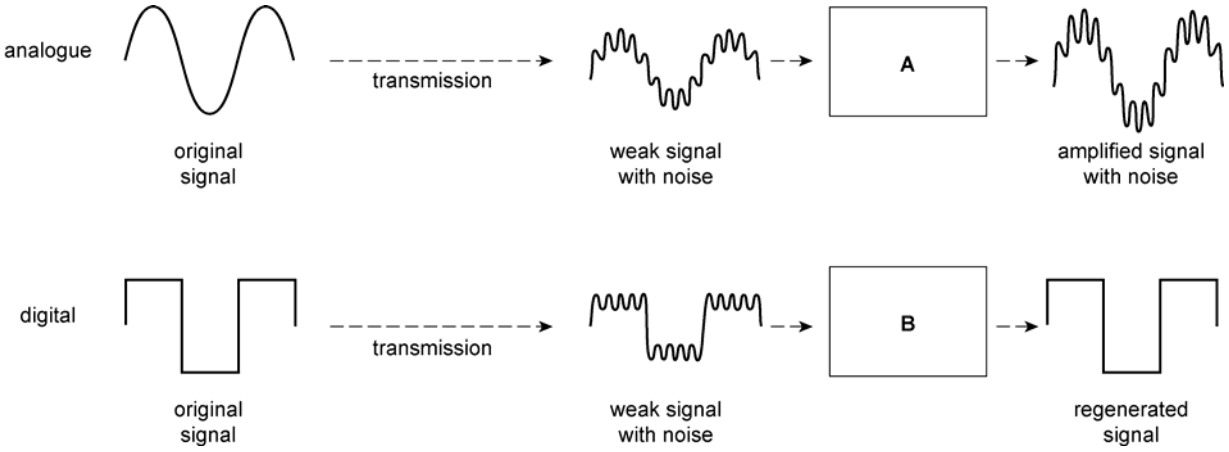
(ii) On another day, Jo estimates the wavelength at 4 metres and the frequency at 2 hertz.

Calculate the speed of the waves.

wave speed = ... units ..... [3]

[Total marks: 5]

2 **(a)** These diagrams are from a textbook about transmitting signals.



(i) What type of device is A ..... [1]

(ii) What type of device is B ..... [1]

(b) The diagrams show the affect of noise on analogue and digital transmissions.

Put ticks (✓) in **three** boxes next to correct statements.

For analogue signals, noise is amplified with signal. ☐

For digital signals, device B removes the noise. ☐

For analogue signals, final signal is not distorted. ☐

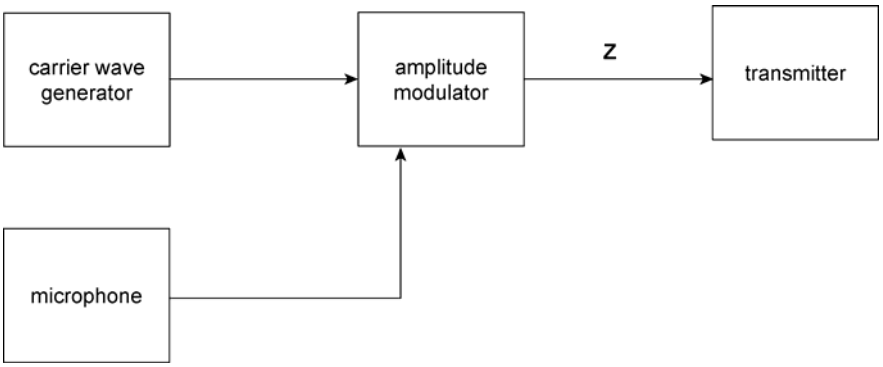
For analogue signals, the noise does not stop 0s and 1s from being identified. ☐

For digital signals, noise is amplified with signal. ☐

For analogue signals, device A removes the noise. ☐

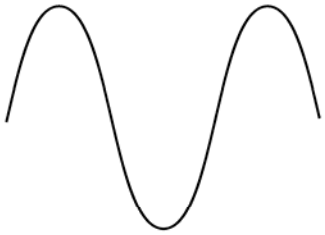
[3]

(c) The original signal can be produced via amplitude modulation.

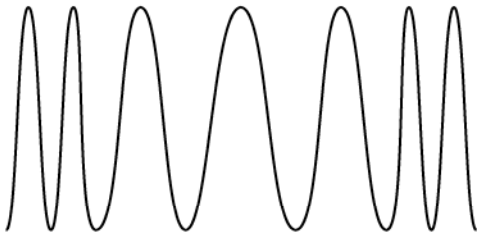


Which two of the following waves **A**, **B**, **C** or **D** would **not** be found at **Z**.

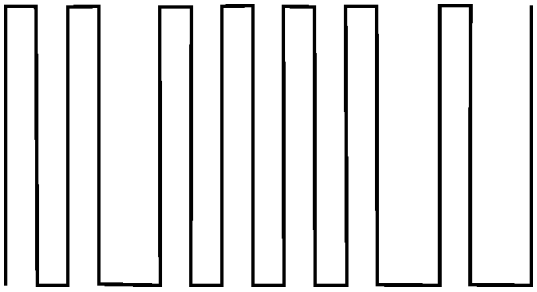
A



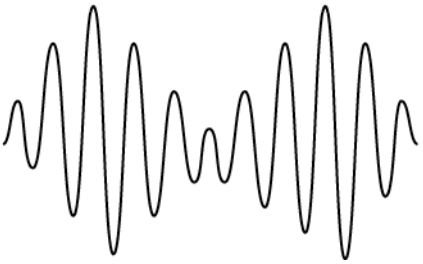
B



C



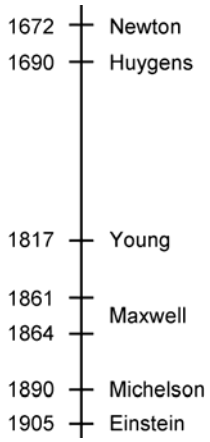
D



wave ..... and wave ..... [2]

[Total marks: 7]

3 Discovering Light



Many scientists have contributed to our knowledge of light.

In 1672, Newton showed that white light was made up of many colours. Newton suggested that light was made of particles.

In 1690, Christiaan Huygens described light as a wave and explained diffraction and interference of light. Thomas Young showed that light was a wave in 1817.

James Clark Maxwell took the first coloured photograph in 1861, and, in 1864, stated that light was an electromagnetic wave.

Between 1880 and 1900, Albert Michelson made very accurate measurements of the speed of light.

In 1905, Albert Einstein explained the photoelectric effect by suggesting that light was made up of photons.

(a) James Clark Maxwell said light was an electromagnetic wave in 1864.

(i) Describe two ways in which electromagnetic waves are different from sound waves.

1 ……

……

2 ……

…… [2]

(ii) Name two ways in which light behaves that is evidence that light is a wave.

1 ……

2 …… [2]

(iii) Michelson measured the speed of light accurately.

What is the speed of light in space (a vacuum)?

…… [1]

(b) Einstein suggested light was made of photons.

What is the relationship between a photon's energy and its frequency?

……

…… [1]

(c) The brightness of a beam of light is called its **intensity**.

Which of the following statements about intensity is correct?

Put ticks (✓) in the boxes next to the **two** correct statements.

Intensity = total energy delivered by the light.	☐
Intensity depends on the energy of each photon.	☐
Intensity depends on the amplitude of each photon.	☐
Intensity depends on the number of photons per second emitted.	☐
If red and blue light have the same intensity, the blue has more photons per second.	☐

[2]

[Total marks: 8]

[Total marks for the test: 20]