Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A332/02

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

UNIT 2: Modules P4 P5 P6
Higher Tier

FRIDAY 19 JUNE 2009: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper
A calculator may be used for this paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (KN) OV91051 15708/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 42.**
- **A list of physics equations is printed on page 4 and 5.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

ELECTRIC CIRCUITS

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

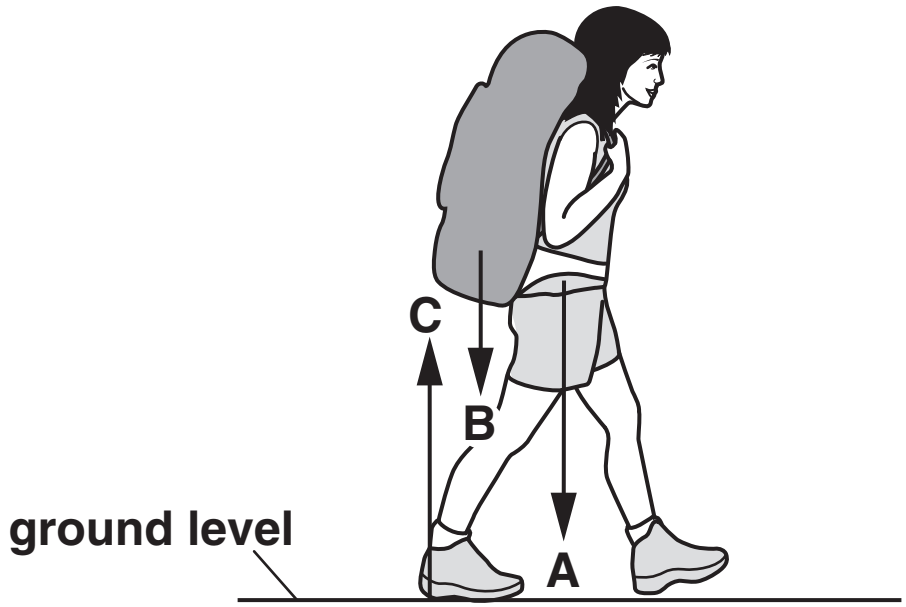
$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

1 Alice is walking with her backpack.

There are 3 vertical forces acting on Alice and her backpack.

A – her weight
B – the weight of her backpack
C – the reaction force upwards from the ground

The diagram below shows the forces.



(a) What is the resultant downward force on Alice?

Put a tick (✓) in the box next to the correct answer below.

A – B – C ☐

A + B + C ☐

A + B – C ☐

A – B + C ☐

[1]

(b) Complete the following sentences about the forces involved when Alice is walking.

Choose the <u>BEST</u> words from the list below.

<u>FRICTION</u>

<u>GRAVITY</u>

<u>INTERACTION</u>

<u>OPPOSITE</u>

<u>REACTION</u>

<u>THE SAME</u>

Use a different word for each sentence.

Alice's back foot produces a backward force, which pushes against the ground.

This causes a force from the ground due to

_____ .

The two forces are the same size and have

directions that are _____ .

These two forces are called a pair of

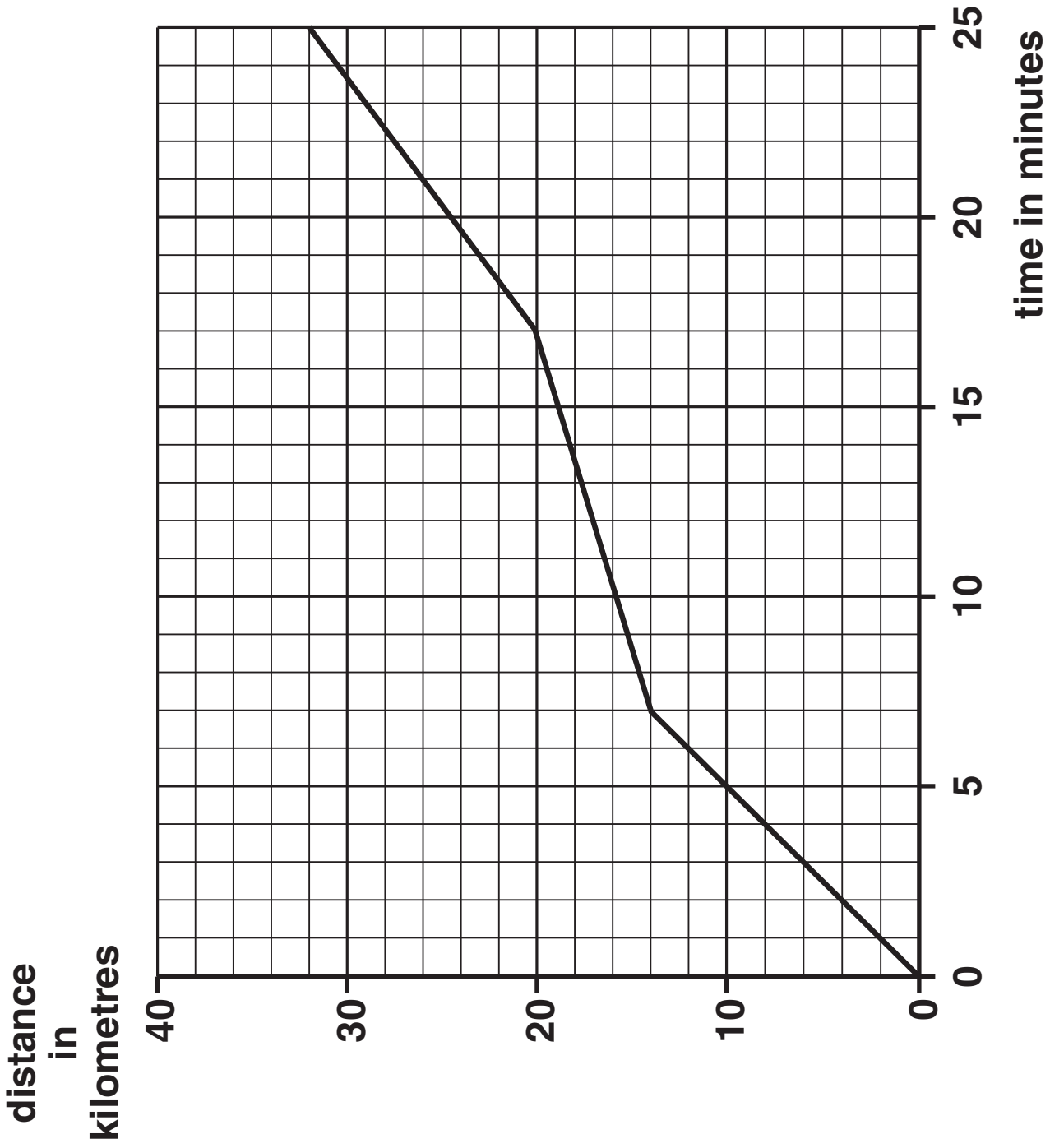
_____ forces.

[3]

[TOTAL: 4]

2 Ann is driving along the motorway.

The graph below shows the journey she takes.



(a) (i) What is Ann's average speed during the whole journey?

average speed = _____ km/min [1]

(ii) What is Ann's speed during the <u>MIDDLE PART</u> of her journey?

speed = _____ km/min [1]

(b) On another journey Ann was carrying some passengers which increased the mass of her car to 1400 kg.

A car pulled out in front of Ann and she had to brake suddenly.

She slowed down from 30 m/s to 14 m/s in 10 seconds.

(i) What was the change in momentum?

Look at list one and put a (ring) around the correct number.

Look at list two and put a (ring) around the correct unit.

LIST ONE

19 600

22 400

42 000

616 000

LIST TWO

g m/s

kg

kg m/s

N

m/s

m/s^2

[2]

(ii) What was the force acting on the car, when she braked?

force = _____ unit _____ [2]

(iii) As Ann approached an exit from the motorway she slowed down from 30 m/s to 14 m/s again.

However the change in speed took about a minute.

The force needed to change the speed was much less than when she braked suddenly.

Look at the list of explanations below.

Put a tick (✓) in the box next to the best explanation for the smaller force.

there is more time for the force to be absorbed	☐
the change in momentum will be less	☐
the force × the time always equals the change in momentum	☐
the braking force and the driving force are not equal	☐

[1]

[TOTAL: 7]

3 Bobby is learning to ski with his father.

(a) As Bobby moves down the hill he gains kinetic energy.

(i) What happens to Bobby's VELOCITY if his kinetic energy is FOUR times bigger?

Put a (ring) around the correct answer in the list below.

A HALF

A QUARTER

DOUBLE

FOUR TIMES BIGGER

THE SAME

[1]

(ii) Bobby's father has twice the mass of Bobby.

Use words in the list below to answer the following question.

A HALF OF

A QUARTER OF

DOUBLE

FOUR TIMES

THE SAME AS

If they were both going at the same velocity how would the kinetic energy be different?

Bobby's kinetic energy will be

_____ his dad's. [1]

(b) At the start, Bobby has gravitational potential energy.

Bobby weighs 400 newtons and the top of the hill is 150 metres vertically above the bottom.

Calculate the amount of gravitational potential energy lost as he goes down the hill.

gravitational potential energy =

_____ unit _____ [2]

[TOTAL: 4]

4 This question is about the electrical energy used by a kettle.

(a) Energy is transferred in the kettle.

Which of the following statements are true about the energy transfer?

Put a tick (✓) in the box next to each correct statement below.

When electric charge flows through the kettle, energy is transferred to the kettle.	☐
The power of the kettle is the rate at which energy is transferred to the kettle.	☐
The energy transferred increases the voltage across the kettle.	☐
All the energy transferred to the kettle heats the water.	☐

[2]

(b) The kettle has a power rating of 2 kW.

The kettle takes 3 minutes to boil some water.

Which TWO of the calculations are correctly working out the energy used?

Put ticks (✓) in the boxes next to the TWO correct calculations below.

2000 × 3 ÷ 60 = 100 kWh	☐
2 × 3 = 6 J	☐
2 × 3 ÷ 60 = 0.1 kWh	☐
2000 × 3 = 6000 J	☐
2000 × 3 × 60 = 360 000 J	☐

[2]

(c) Kettles in the home use the voltage of the mains electrical supply.

A different kettle uses a current of 10 amps.

What is the power of this kettle?

Put a (ring) around the correct answer in the list below.

10W 23W 24W 2300W 2500W

[1]

[TOTAL: 5]

5 A generator is made using a magnet which spins near a coil of wire.

The generator produces a changing voltage.

(a) (i) Which of the following words best describes this process?

Put a (ring) around the correct answer in the list below.

DEDUCTION

FORMATION

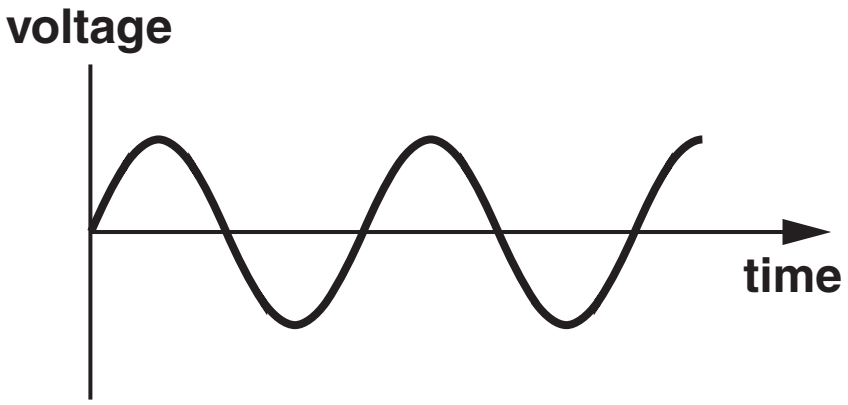
INDUCTION

REDUCTION

TRANSFORMATION

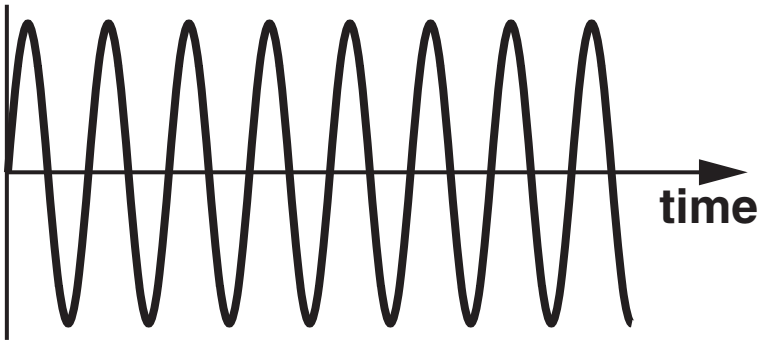
[1]

(ii) The graph below shows how the voltage produced by the generator changes with time when the magnet spins at a particular speed.

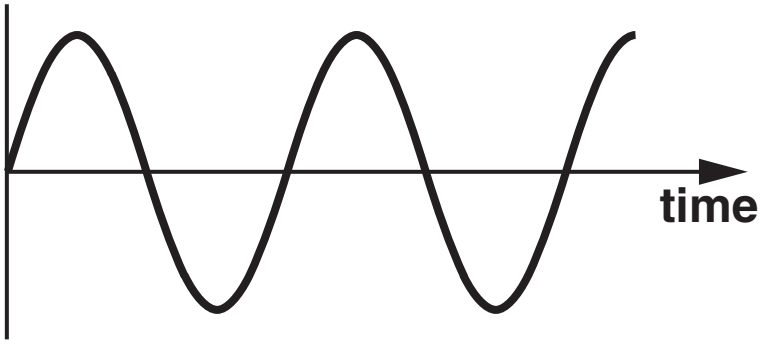


The following graphs all have the same scales as the graph on the previous page.

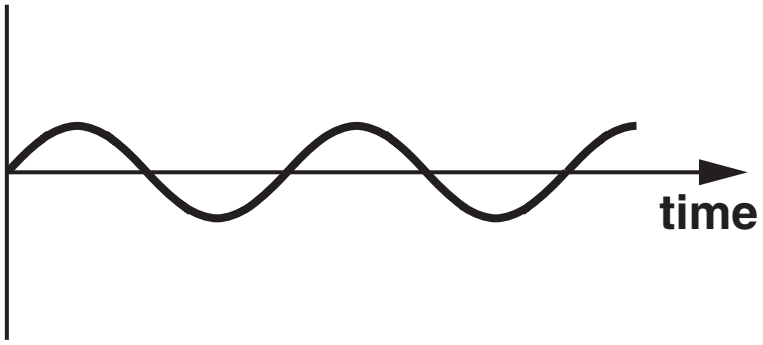
A voltage



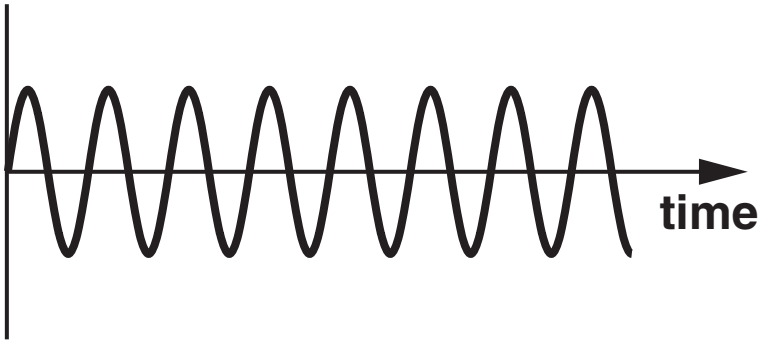
B voltage



C voltage



D voltage

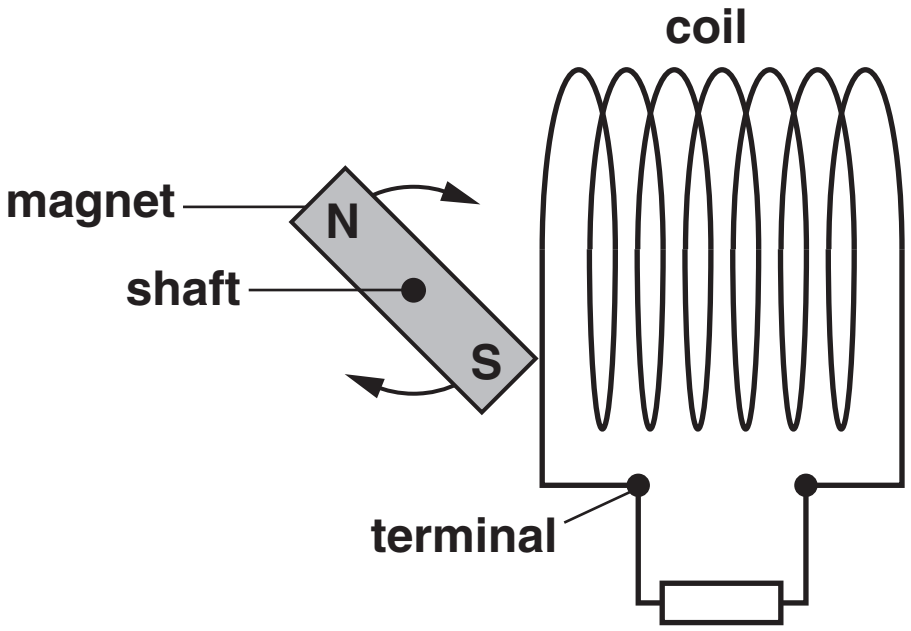


Complete the table with the letter of the graph that shows what would happen for each of the changes, with all other factors kept the same. Each letter can be used once, more than once, or not at all.

A weaker magnet is used.	
The number of coils in the wire is increased.	
An iron core is put in the middle of the coil of wire.	
The magnet is spun faster.	

[4]

(b) When a resistor is connected across the terminals of the generator coil, a current flows in the circuit.



Use the words in the list below to complete the following sentences describing the current.

NEGATIVE

OPPOSITE

POSITIVE

POTENTIAL DIFFERENCE

RESISTANCE

SAME

As the _____ increases

there is a greater current in the resistor.

The current is made up of many electrons moving in the _____ direction.

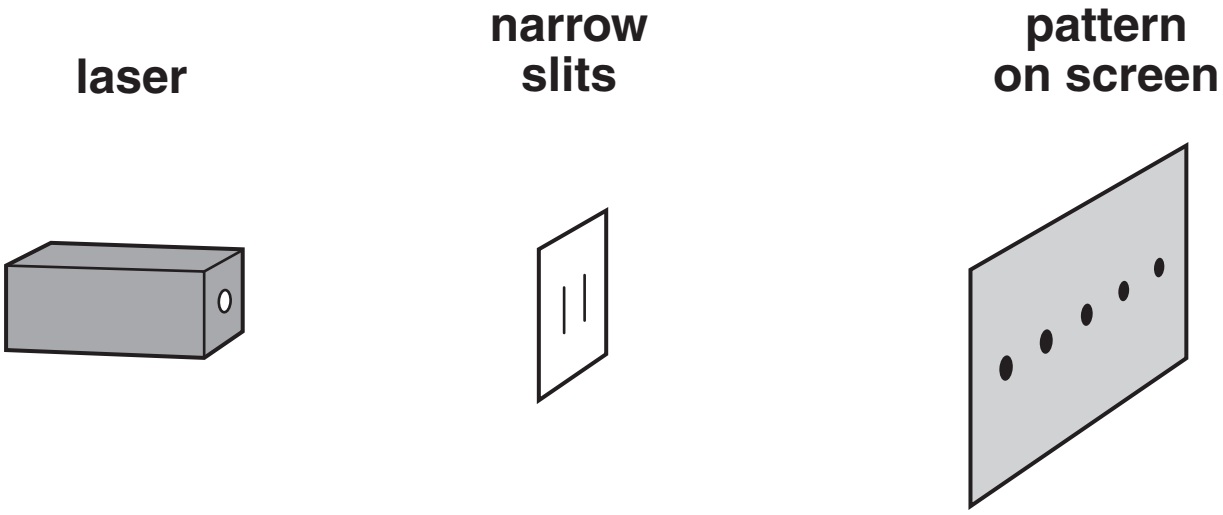
As the voltage changes direction, the electrons move in the _____ direction.

The _____ electrons are always attracted to the _____ terminal of the generator coil.

[3]

[TOTAL: 8]

6 Miss Curie demonstrates the interference of light waves to her class by shining a laser beam through two narrow slits. This produces a pattern of bright and dark areas on a screen.



Below is a list of words that Miss Curie used in her explanation of the experiment.

AMPLITUDE

BRIGHT

CONSTRUCTIVE

DARK

DESTRUCTIVE

DIFFRACTION

FREQUENCY

WAVELENGTH

(a) Complete the following explanation by choosing the best words from the list.

Where the two light waves from the slits meet, the

_____ of each wave adds together.

If the waves are in step they produce a

_____ area.

This is called _____ interference.

[3]

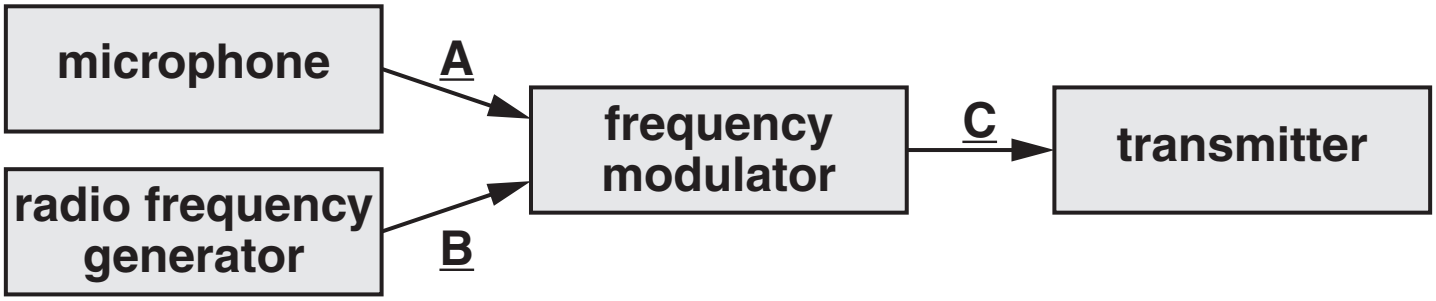
(b) Which word in the list means that the waves spread out from the slits?

_____ [1]

[TOTAL: 4]

7 A reporter is testing his radio transmission system by whistling into his microphone.

The signals are modulated on to a radio carrier wave and transmitted.

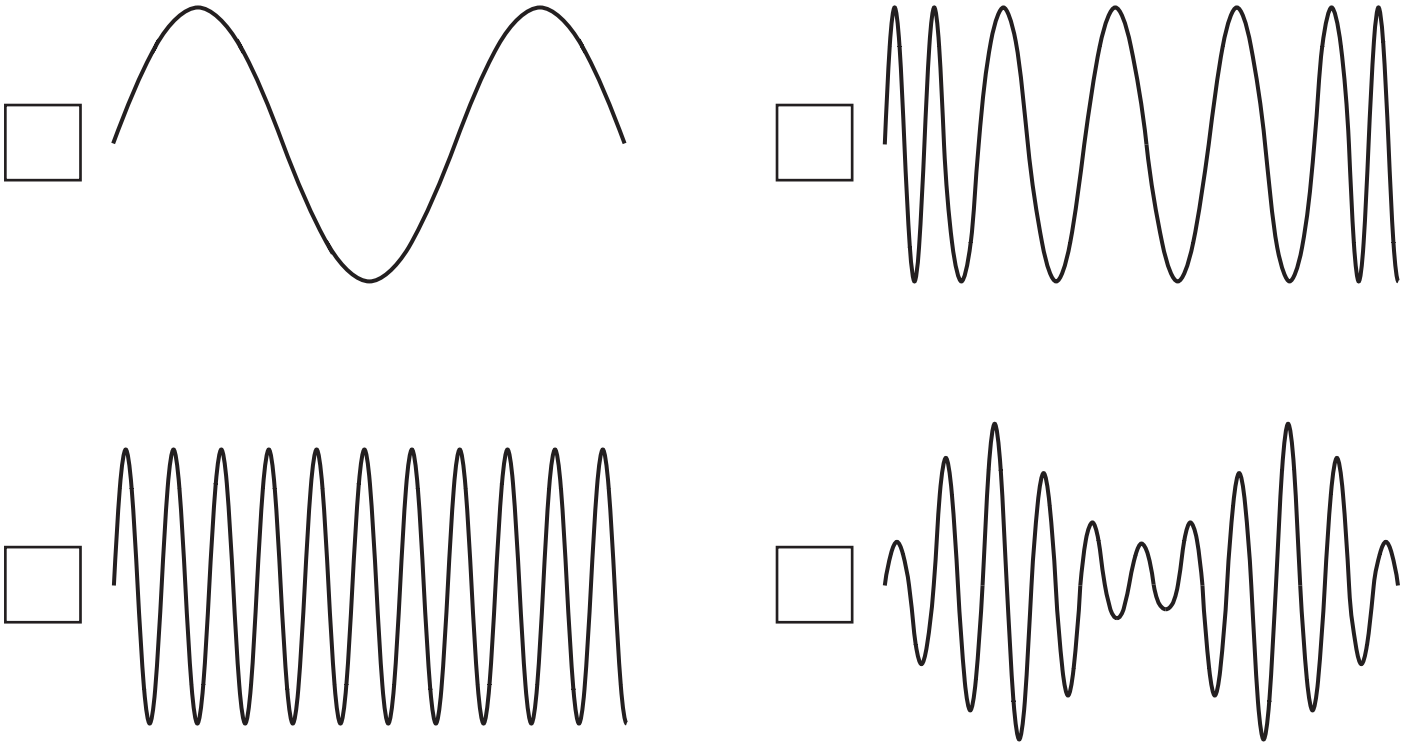


(a) The signals at A, B and C will all look different.

Look at the diagrams below.

Which signal will be found at A, B and C?

Write the letters A, B and C in the boxes beside the THREE correct signals.



[3]

(b) The carrier wave has a frequency of 200 MHz.

The speed of the radio waves is 300,000,000 m/s.

What is the wavelength of the carrier wave?

Put a (ring) around the correct answer in the list below.

6.7×10^{-7} m

1.5 m

0.67 m

1.5×10^{6} m

6×10^{10} m

6×10^{16} m

[1]

(c) The reporter will be seen on the television.

Most television transmission systems are switching from analogue signals to digital signals.

Which of the following apply to <u>ANALOGUE SIGNALS</u>?

Put a tick (✓) in the box next to each correct statement below.

signals are coded as 0 s and 1 s	☐
signals lose intensity as they travel	☐
signals pick up noise as they travel	☐
signals are modulated for transmission	☐
signals are decoded to produce the original sound	☐

[2]

[TOTAL: 6]

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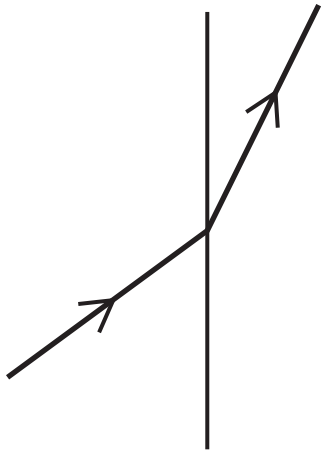
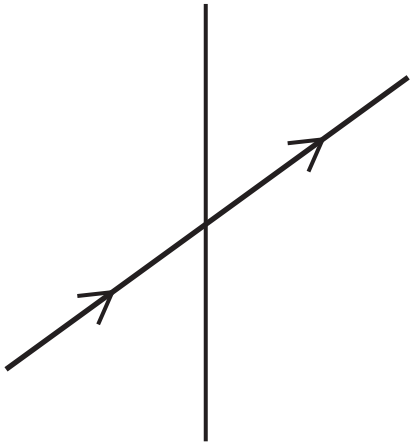
8 Refraction of a wave can be explained by a change in the speed of a wave.

(a) The diagrams below show a ray of light before and after it is incident at a boundary between different transparent materials.

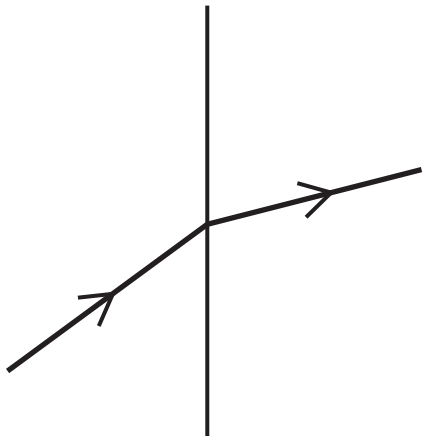
A



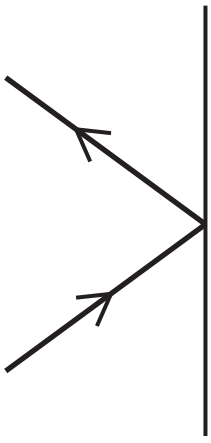
B



C



D



(i) Which diagram shows the beam slowing down after it is incident at the boundary, A, B, C or D?

_____ **[1]**

(ii) In which diagrams does the wavelength of the wave change, A, B, C or D?

_____ **[1]**

(b) Which of the following do <u>NOT</u> affect the speed of a wave?

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

what the wave is travelling through (the medium)	☐
the amplitude of the wave	☐
the type of wave (e.g. sound or light)	☐
the reflection of the wave	☐
the frequency of a light wave in space	☐

[2]

[TOTAL: 4]

<u>END OF QUESTION PAPER</u>

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