OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A332/02

PHYSICS A

Unit 2: Modules P4 P5 P6
(Higher Tier)

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)

Friday 19 June 2009
Morning

Duration: 40 minutes

A332/02

OCE/10935

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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 two.
- This document consists of **16** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

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

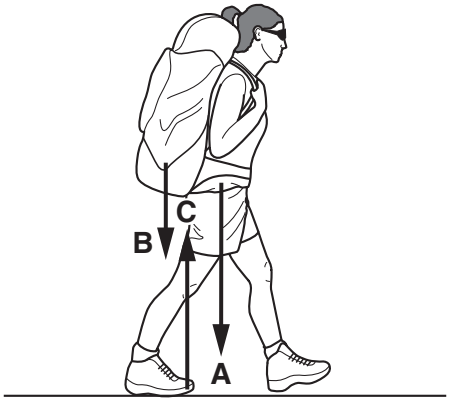
$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer **all** the questions.

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



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

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

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 **best** words from the list.

Use a different word for each sentence.

friction **gravity** **interaction** **opposite** **reaction** **the same**

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

This causes a force from the ground due to …… .

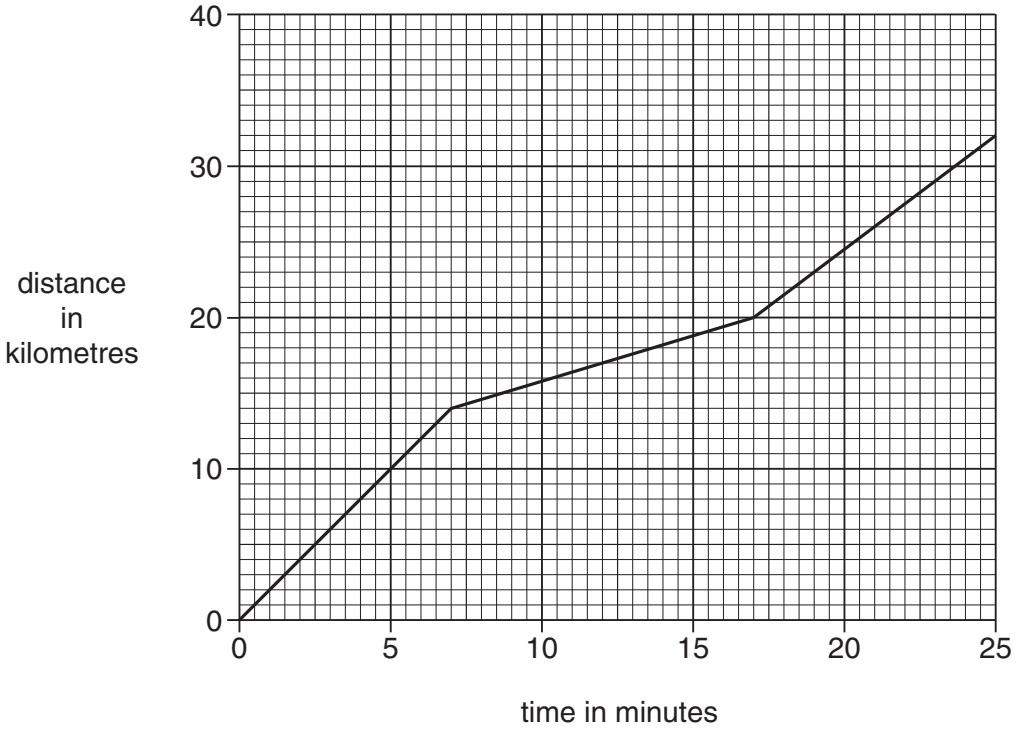
The two forces are the same size and have directions that are …… .

These two forces are called a pair of …… forces. **[3]**

[Total: 4]

2 Ann is driving along the motorway.

The graph 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 **middle part** 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?

Put a (ring) around the correct number **and** a (ring) around the correct unit.

19 600	**22 400**	**42 000**	**616 000**

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.

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.

a half **a quarter** **double** **four times bigger** **the same**

[1]

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

Use words from this list 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.

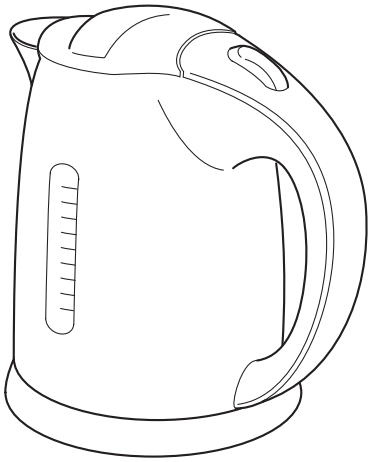
Bobby weighs 400 newtons and the top of the hill is 150 metres vertically above the bottom.

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.

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.

$2000 \times 3 \div 60 = 100\,\text{kWh}$	☐
$2 \times 3 = 6\,\text{J}$	☐
$2 \times 3 \div 60 = 0.1\,\text{kWh}$	☐
$2000 \times 3 = 6000\,\text{J}$	☐
$2000 \times 3 \times 60 = 360\,000\,\text{J}$	☐

[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 power.

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.

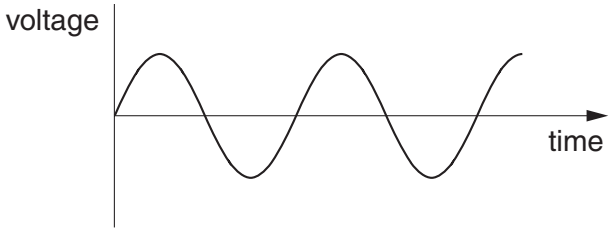
(a) **(i)** Which of the following words best describes this process?

Put a (ring) around the correct answer.

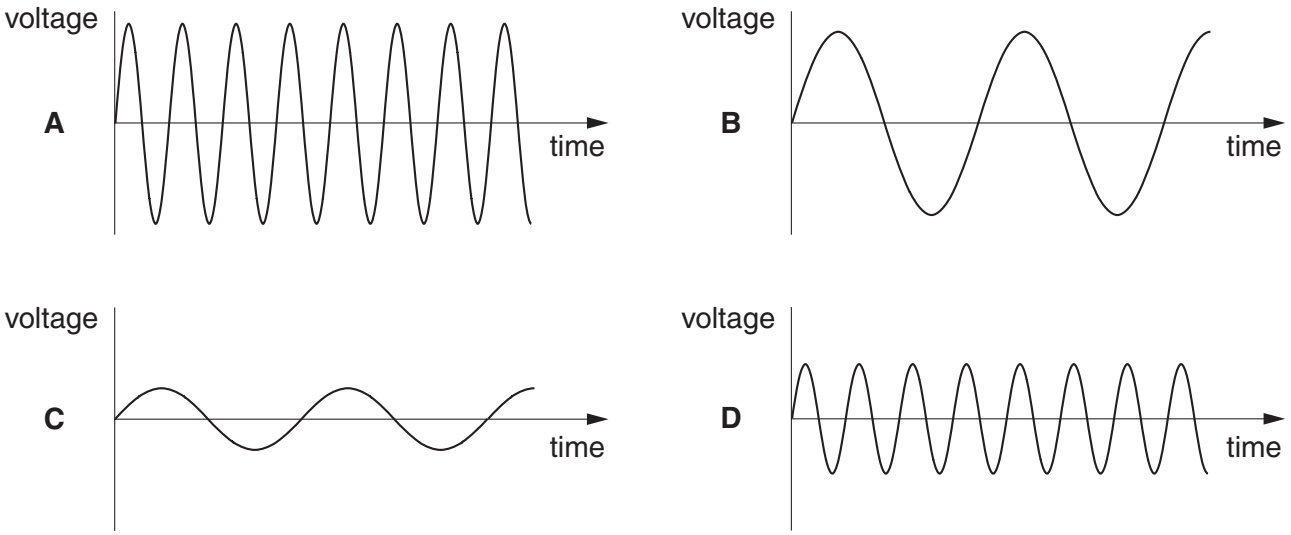
deduction **formation** **induction** **reduction** **transformation**

[1]

(ii) The graph 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 above.

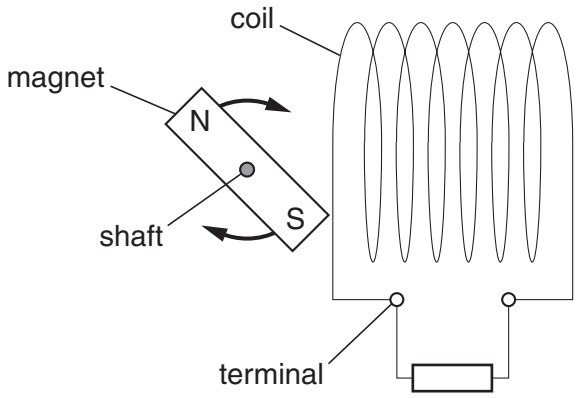


Complete the table with the letter of the graph that shows what would happen for each of the changes, with all other factors kept the same.
Each letter can be used once, more than once, or not at all.

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 to complete the 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.

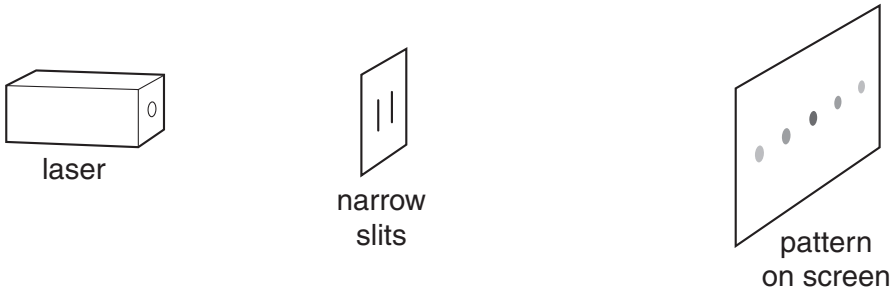
As the voltage changes direction, the electrons move in the …… direction.

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.



This 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 this 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]

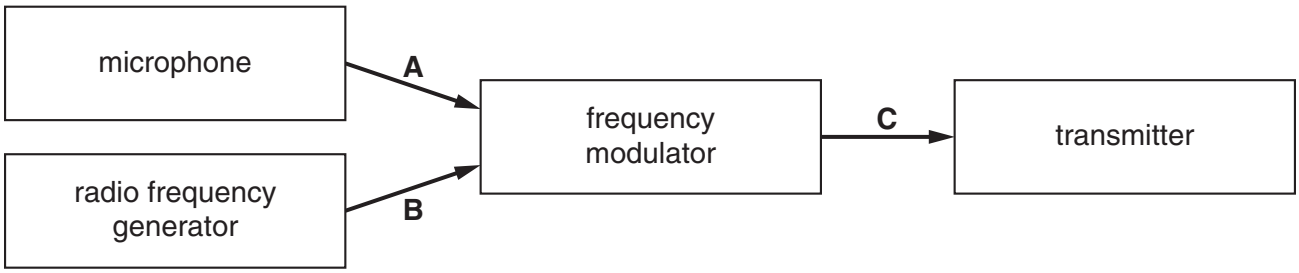
(b) Which word in the list means that the waves spread out from the slits?

..... **[1]**

[Total: 4]

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

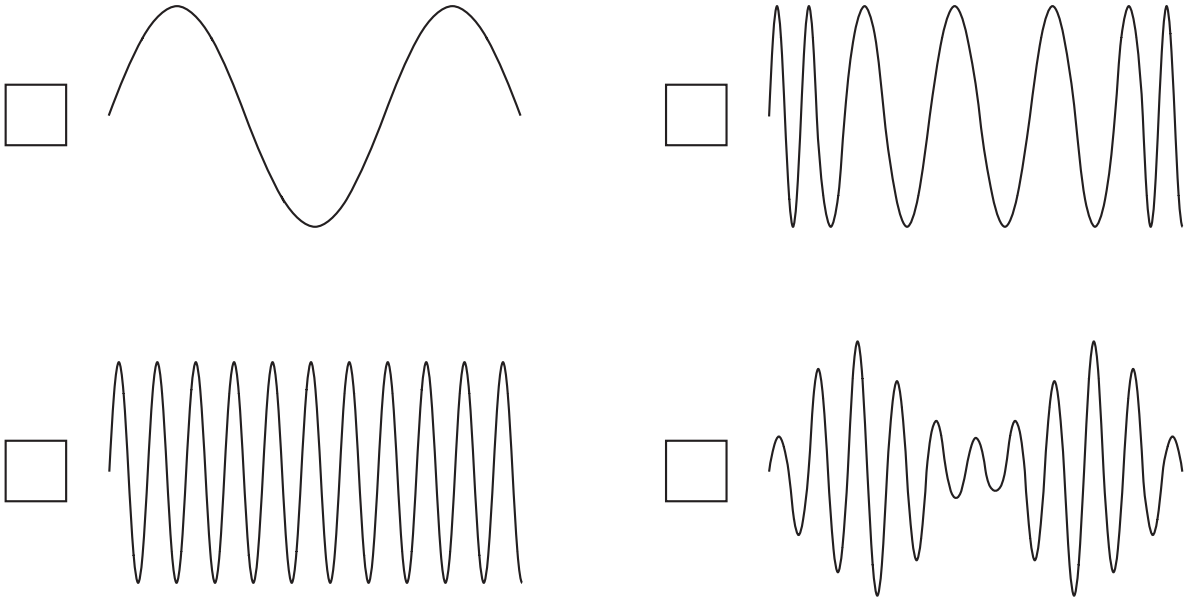
The signals are modulated on to a radio carrier wave and transmitted.



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

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.

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 **analogue signals**?

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

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 ☐

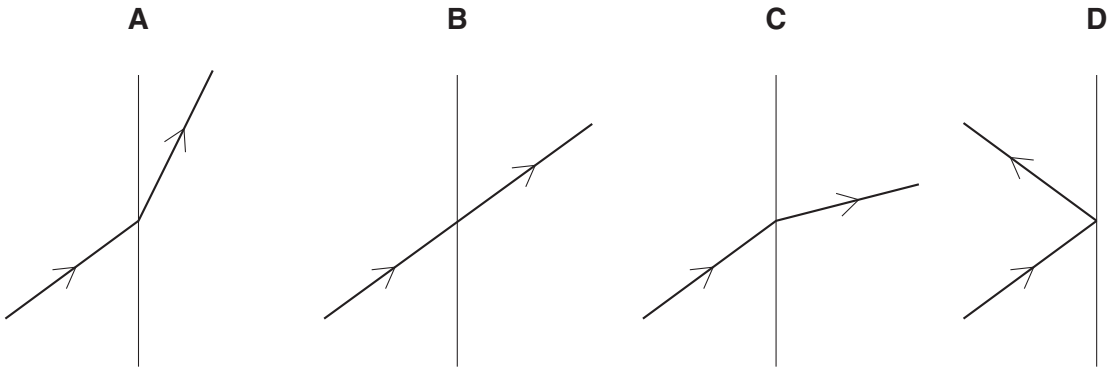
signals are decoded to produce the original sound ☐

[2]

[Total: 6]

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

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



(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 **not** affect the speed of a wave?

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

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]

END OF QUESTION PAPER

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