THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

# Thursday 2 February 2012 – Morning

## GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A

**A332/01** Unit 2: Modules P4 P5 P6 (Foundation 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)

**Duration:** 40 minutes



| Candidate forename | | Candidate surname | |
|---|---|---|---|

| Centre number | | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

## MODIFIED LANGUAGE

### INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

### INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page **2**.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

# TWENTY FIRST CENTURY SCIENCE EQUATIONS

## Useful Relationships

### Explaining Motion

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

momentum = mass × velocity

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

work done by a force = force × distance moved in the direction of the force

change in energy = work done

change in GPE = weight × vertical height difference

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

### Electric Circuits

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

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

energy transferred = power × time

power = potential difference × current

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

### The Wave Model of Radiation

wave speed = frequency × wavelength

**BLANK PAGE**

**Question 1 starts on page 4**

**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

**1** This question is about a wind turbine.

**(a)** The turbine blades are attached to a generator.

In the generator there is a magnet inside a coil of wire.

Here are four statements about how the generator works.

They are in the **wrong order**.

**A** A voltage is induced across the ends of the coil.

**B** The magnet rotates inside the coil.

**C** There is a current in the wire.

**D** The wind turns the turbine blades.

Fill in the boxes with the letters **A**, **B**, **C** and **D** to show the correct order.

| | | | |
|---|---|---|---|
| | | | |

**[2]**

**(b)** What would **increase** the size of the voltage produced by the generator?

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

| | |
|---|---|
| turning the magnet faster | ☐ |
| heating the wire | ☐ |
| having more turns on the coil | ☐ |
| placing a wooden core inside the coil | ☐ |
| using a weaker magnet inside the coil | ☐ |

**[2]**

**(c)** The generator produces alternating current (a.c.).

Which of the statements about alternating current are **true**?

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

Alternating current...

| | |
|---|---|
| ... does not need a closed circuit. | ☐ |
| ... can be used with transformers. | ☐ |
| ... is only made in wind turbines. | ☐ |
| ... does not transfer energy. | ☐ |
| ... changes direction. | ☐ |

**[2]**

**(d)** Brian has a model wind turbine.

The blades of the model turbine are made of plastic.

When the blades are rubbed with a cloth, bits of dust get stuck to them.

Use words from this list to complete the sentences to explain why.

**attracted** **conducted** **electrons** **negatively**

**neutrally** **photons** **positively** **protons** **repelled**

When a plastic blade is rubbed with a cloth, ..... are transferred from the blade to the cloth.

The blade then becomes ..... charged.

Dust is ..... to the charged blade. **[3]**

**[Total: 9]**

**2** Barry decorates his house with Christmas lights.

**(a)** Barry uses an LDR in the circuit so that the lights switch on automatically at night.

**(i)** One property of an LDR changes when it gets dark.

Put a (ring) around the property that changes when it gets dark.

**efficiency** **resistance** **temperature**

Put a (ring) around the correct option to show how this property changes when the light intensity decreases.

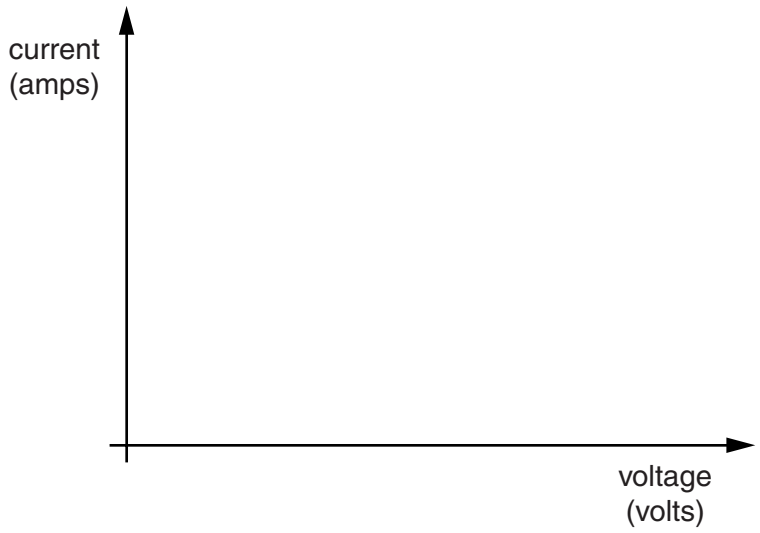
**increases** **decreases** **stays the same**

**[1]**

**(ii)** The circuit also contains fixed resistors.

Sketch a graph on the axes below to show how the current varies with voltage for a fixed resistor.

The temperature of the resistor does not change.




**[1]**

**(b)** Each of the light bulbs on Barry's house has a value of 15 W.

What does this mean?

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

The bulb...

... has an efficiency of 15%. ☐

... uses 15 amps of current. ☐

... uses a potential difference of 15 volts. ☐

... transfers 15 joules of energy every second. ☐

**[1]**

**(c)** Each light bulb has a filament inside.

Explain why the filament glows when the light bulb is switched on.

.....

.....

..... **[2]**

**(d)** Barry used the lights for 20 nights, for 10 hours each night.

The total power used by the light bulbs was 1.5 kW.

The cost per kWh was 10p.

How much does Barry have to pay for the electricity used by the lights?

Put a (ring) around the correct answer.

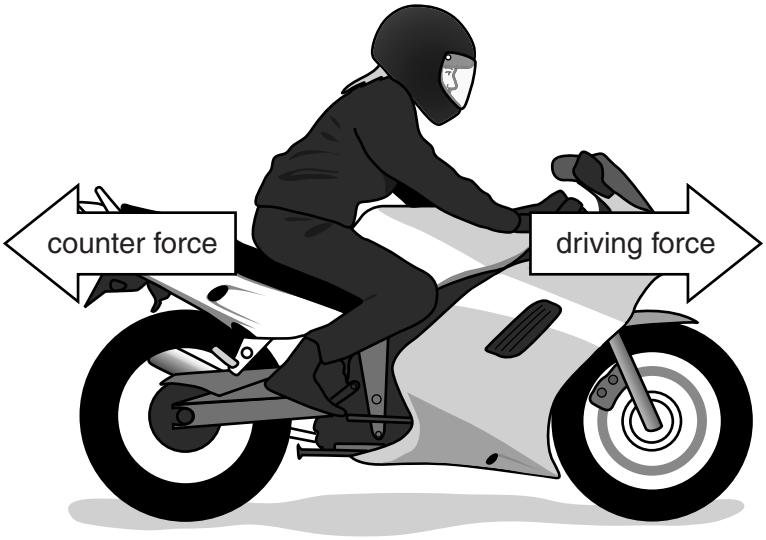
**£0.30** **£30.00** **£300.00** **£30 000.00**

**[1]**

**[Total: 6]**

**3** Nadia rides a motorbike.

**(a)** The picture shows two of the forces acting on Nadia's motorbike.




The motion of the motorbike depends on the size of each force.

**(i)** Draw **three** straight lines to show **what happens** to the motorbike as the **forces** change.

| **what happens** | **forces** |
|---|---|
| The motorbike **speeds up** when... | ...the driving force is **the same as** the counter force. |
| The motorbike **slows down** when... | ...the driving force is **greater than** the counter force. |
| The motorbike moves at a **constant speed** when... | ...the driving force is **smaller than** the counter force. |

**[2]**

**(ii)** What happens to the momentum of the motorbike in each of the following situations?

Put a tick (✓) in the correct box for each situation.

| **situation** | **momentum** | | |
|---|---|---|---|
| | **increases** | **decreases** | **stays the same** |
| the motorbike moves at a steady speed | | | |
| the motorbike slows down | | | |
| the motorbike speeds up | | | |

**[1]**

**(b)** The total mass of Nadia and the motorbike is 250 kg.

The speed of the motorbike is 20 m/s.

Calculate the kinetic energy of Nadia and the motorbike.

Show your working.

kinetic energy = ..... J **[2]**

**(c)** Nadia slows down and stops on a flat and level road.

Describe the energy transfers that take place when she slows down and stops.

.....

.....

.....

..... **[2]**

**[Total: 7]**

**4** Emily uses an exercise bike in her gym.

The exercise bike uses friction against a rotating wheel. This makes the rider feel like she is cycling along a road.

**(a)** The friction force is 50 N.

The display on the bike tells Emily that she has travelled 100 m after 10 s.

How much work is done by Emily during this time?

Show your calculation.

work done = ..... J **[2]**

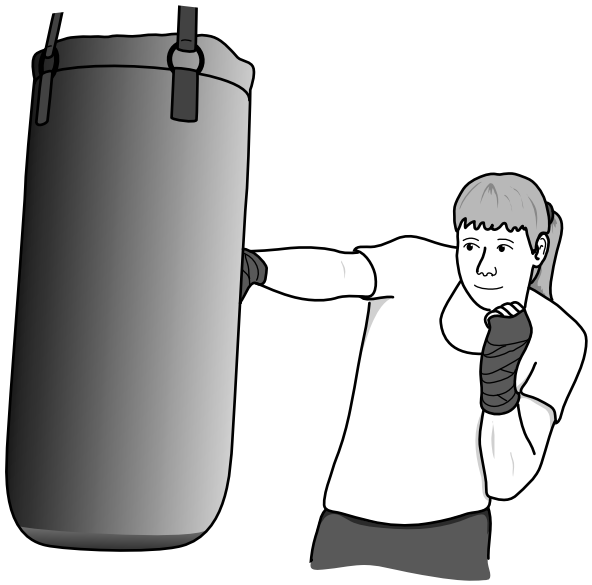
**(b)** Emily and her friends discuss the energy transfers that take place when she uses the exercise bike.

Only one of them is correct.


Which person is making a **correct** statement?

answer = ..... **[1]**

**(c)** Emily uses a punch bag.



**(i)** When Emily hits the bag, it gains kinetic energy.

Which factors affect how much kinetic energy the bag gains?

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

| | |
|---|---|
| the amount of light hitting the bag | ☐ |
| the amount of work done on the bag | ☐ |
| the colour of the bag | ☐ |
| the force with which Emily hits the bag | ☐ |
| the height of the bag above the floor | ☐ |

**[2]**

**(ii)** The straps holding the bag break.

The bag falls.

Which of the following describes the energy transfer that takes place?

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

| | |
|---|---|
| kinetic energy → gravitational potential energy | ☐ |
| sound energy → kinetic energy | ☐ |
| gravitational potential energy → light energy | ☐ |
| gravitational potential energy → kinetic energy | ☐ |

**[1]**

**[Total: 6]**

**5** Lucas shines a laser through two narrow slits onto a wall.

He notices that there are lighter and darker patches in the light on the wall.

He writes an explanation.

Complete the explanation by filling in the missing words.

Use words from this list.

**amplitudes** **constructive** **destructive** **diffraction**

**frequencies** **refraction** **reflection** **wavelengths**

The light from the laser travels as waves.

As the light passes through the slits, it spreads out. This is called ..... .

Where two waves meet, their ..... add and this is called interference.

When two waves arrive in step they reinforce.

This is called ..... interference.

When two waves arrive out of step they cancel out.

Darker patches are caused when there is ..... interference.

**[3]**

**[Total: 3]**

**6** Kim lists the parts of the electromagnetic spectrum.

**(a)** She misses out some of the parts.

| | | | | | | |
|---|---|---|---|---|---|---|
| | X-rays | | visible light | infrared | microwaves | radio waves |

smallest ⟶ biggest

**(i)** Add the missing parts of the spectrum to the list. **[2]**

**(ii)** Going from left to right, what property is **increasing** in Kim's list?

Put a (ring) around the correct answer.

**energy** **frequency** **wavelength** **wave speed**

**[1]**

**(b)** Different parts of the electromagnetic spectrum are used for different purposes.

Draw straight lines to link each **part of the electromagnetic spectrum** to its **use**.

| part of the electromagnetic spectrum | use |
|---|---|
| X-rays | to produce shadow pictures of bones |
| microwaves | to carry information along optical fibres |
| visible light | to carry satellite signals |

**[2]**

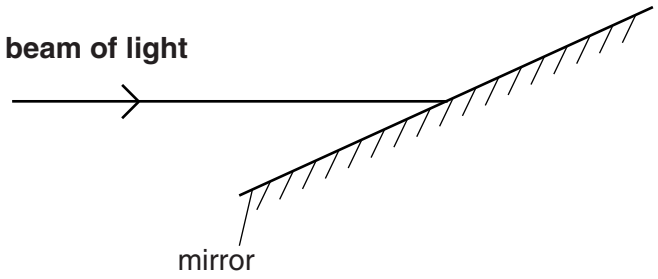
**[Total: 5]**

**7** Light sometimes changes direction when it hits different objects.

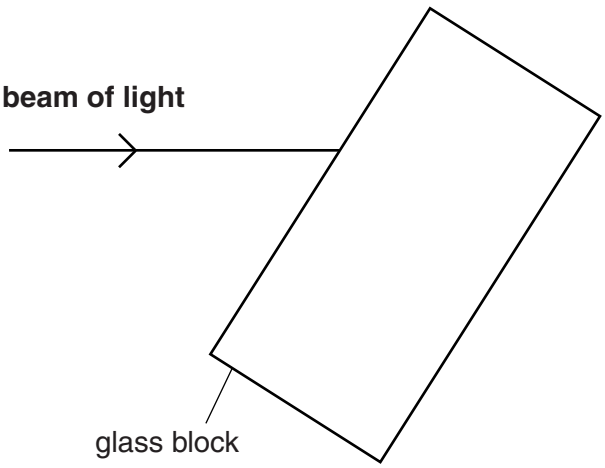
For each diagram below

- complete the diagram to show where the **beam of light** travels after hitting the object
- write down the name of the **process** involved. Choose from the options in the box below.

| | | | | |
|---|---|---|---|---|
| **diffraction** | **interference** | **reflection** | **refraction** | **total internal reflection** |




**process** = .....




**process** = .....

**[6]**

**[Total: 6]**

**END OF QUESTION PAPER**

**PLEASE DO NOT WRITE ON THIS PAGE**