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)

WEDNESDAY 26 MAY 2010: 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 (NF/SLM) MEP60519 31701/1

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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).**

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 pages four and five.**

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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

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

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

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

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

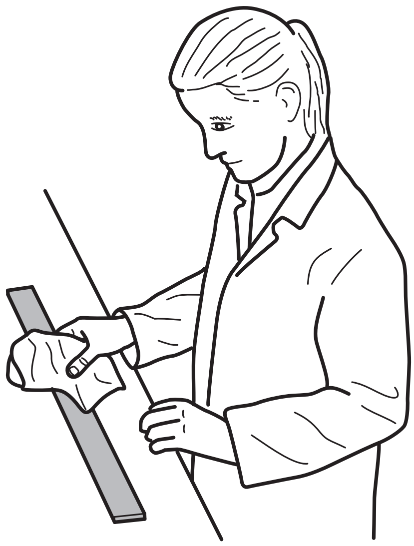
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

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

Answer ALL the questions.

1 Gemma is doing an experiment with a duster and some plastic rods.



(a) When she rubs the rod with the duster, the rod becomes negatively charged.

(i) Which particles have been transferred to the rod to make it NEGATIVELY charged?

Put a (ring) around the correct answer.

ELECTRONS

NEUTRONS

NUCLEI

PROTONS

[1]

(ii) What charge does the DUSTER gain, by charging the rod?

Put a (ring) around the correct answer.

NEGATIVE

NONE

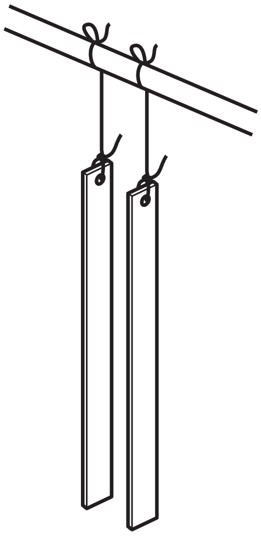
NORTH

POSITIVE

SOUTH

[1]

(b) **Gemma rubs a second identical rod with the same duster. The second rod also becomes negatively charged.**



(i) **The two charged rods are hung very close to each other. What happens to them?**

Place a tick (✔) in the box next to the correct answer.

The rods stay still and do not move.	☐
The rods move together and touch.	☐
The rods move away from each other.	☐
The rods spin around together.	☐ **[1]**

(ii) **Explain why this happens.**

____

____

____ **[2]**

(c) Gemma now rubs a metal rod with the duster. The metal rod does <u>NOT</u> become charged.

Her friend Liam explains that this is because the metal can conduct electricity.

Put a tick (✔) in the correct box to complete the best explanation of why metals can conduct electricity.

Metals can conduct electricity because…

… they have high melting points. ☐

… they have lots of free electrons that can move. ☐

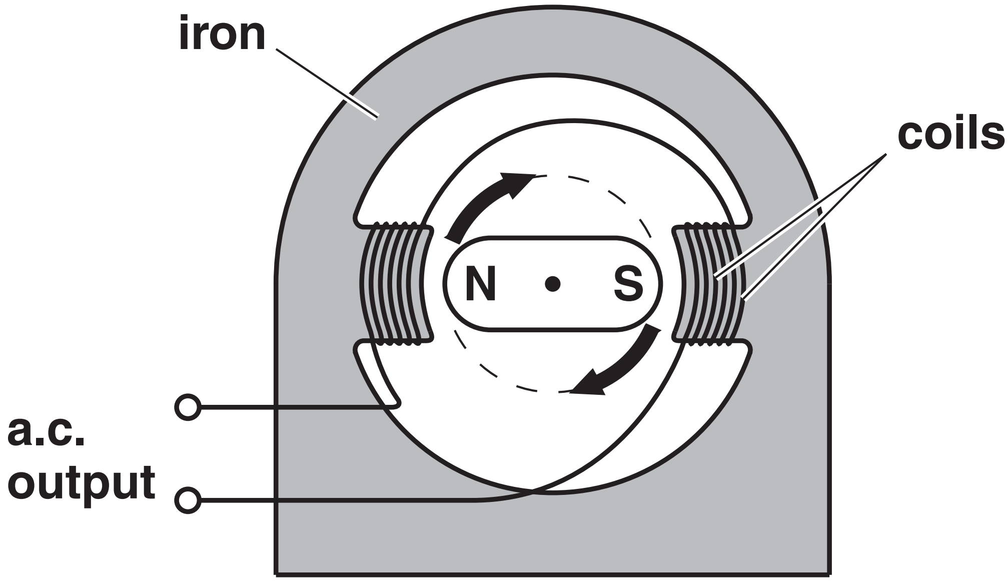
… they conduct heat very well. ☐

… they are shiny. ☐

[1]

[Total: 6]

2 **Rishi makes a model power station.**



(a) **The generator in Rishi's power station is made from magnets and coils of wire.**

Explain the process of electromagnetic induction and how it produces electricity in the generator.

____

____

____

____

____ **[3]**

(b) **The generator in a real power station produces a very large voltage. This voltage has to be reduced to make it safe to use in homes.**

What is the name of the device that changes the voltage?

____ **[1]**

(c) **(i)** **What type of current does the generator produce for mains electricity?**

____ **[1]**

(ii) **Why is this type of current used for mains electricity?**

Put a tick (✔) in the boxes next to the BEST explanations.

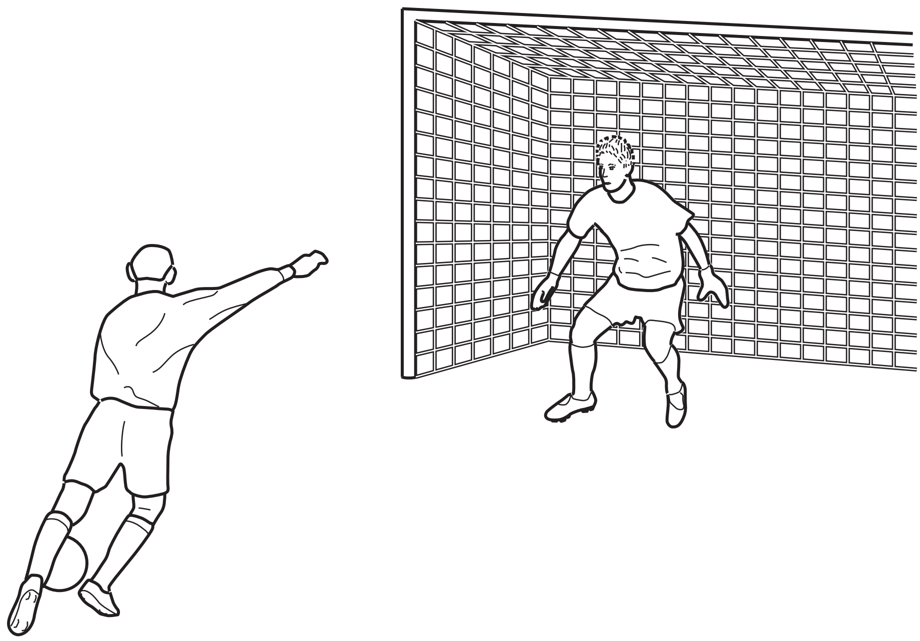
This type of electricity is used because it is …

… faster to generate.	☐
… easier to generate.	☐
… used in more appliances.	☐
… less polluting.	☐
… more efficient to distribute.	☐

[2]

[Total: 7]

3 Ian is playing football.



(a) Ian kicks a stationary football. The football travels in a straight line towards the goal.

The ball travels with a velocity of 20 m/s, and has a mass of 450 g.

(i) Calculate the kinetic energy of the ball.

You must show your working.

answer = ______________________ J [2]

(ii) How much work did Ian do on the football?

answer = ______________________ J [1]

(b) There was a force on the ball when it was kicked. This force is part of an interaction pair.

Describe the partner force of the kicking force in the interaction pair.

____

____

____ **[2]**

(c) Driving home from the game of football Ian has a collision.

The air bag in his car stops his head hitting the steering wheel.

How does the air bag prevent Ian from being badly hurt?

Draw one straight line from the best REASON FOR THE AIR BAG to the EFFECT.

Draw ANOTHER straight line from this EFFECT to the RESULT.

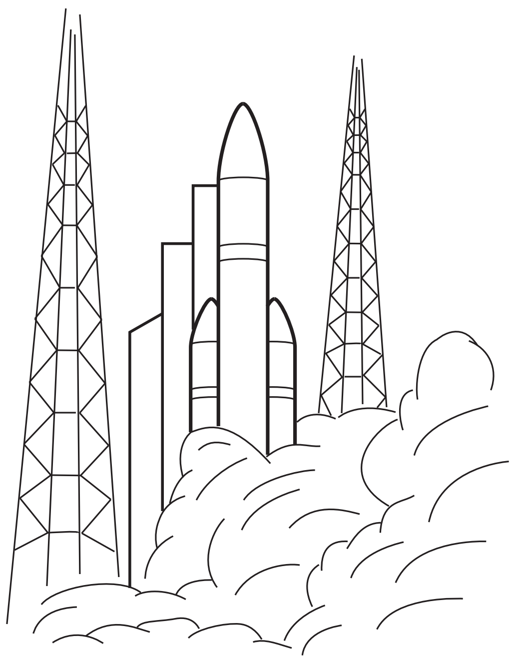
REASON FOR THE AIR BAG	EFFECT	RESULT
air bag increases the time taken for Ian's head to stop	the change of momentum takes place more slowly	the force on Ian's head increases
air bag inflates slowly	the change of momentum takes place more quickly	the force on Ian's head stays the same
air bag decreases the time taken for Ian's head to stop	the time for the change in momentum remains the same	the force on Ian's head decreases
air bag deflates quickly		

[2]

[Total: 7]

4 In 2007, an Ariane rocket set a new record for a launch.

It lifted a mass of 10 tonnes.



(a) The rocket engine burns fuel to produce an upwards force.

Explain how this makes the rocket go upwards.

In your answer you should include:

- how burning the fuel produces the upwards force
- the forces acting on the rocket
- the relative sizes of the forces.

____

____

____

____

____ [3]

(b) The Ariane rocket and payload weigh 10 000 kN.

Calculate the gravitational potential energy, in kJ, of the rocket when it is 70 m from the ground.

Ignore any change in weight.

answer = ____________________ kJ [1]

(c) As the rocket launches it does some work.

When the rocket reaches 1km above the ground, it has done 1.3×10^{10} J of work.

Calculate the average force the rocket produces.

You must show your working.

answer ____________________ N [2]

[Total: 6]

5 **This question is about waves.**

(a) Waves move from one place to another place.

Put ticks (✔) in the boxes to show what moves from place to place.

matter	☐
energy	☐
disturbances	☐
particles	☐
charge	☐

[2]

(b) **Waves are either <u>LONGITUDINAL</u> or <u>TRANSVERSE</u>.**

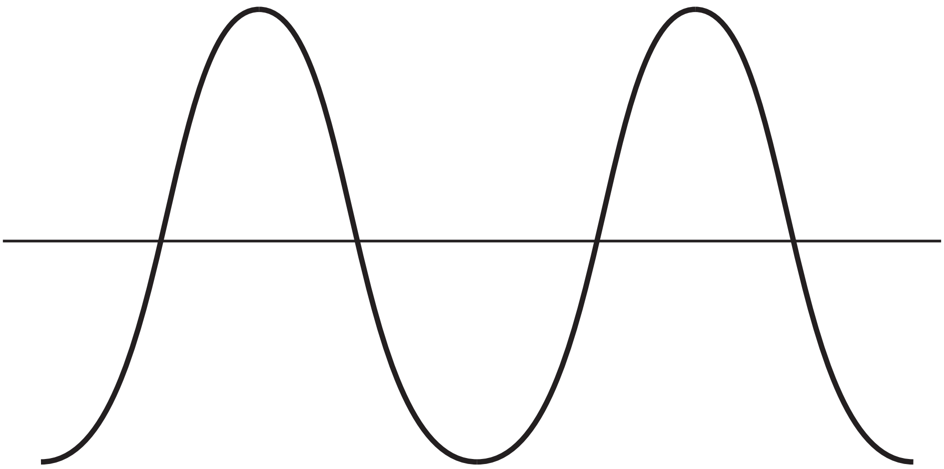
Draw a straight line from each <u>DESCRIPTION</u> to the correct <u>TYPE OF WAVE</u>.

DESCRIPTION	**TYPE OF WAVE**
travels in the same direction as the vibrations	
travels at right angles to the direction of the vibration	longitudinal wave
needs a medium to travel in	
some can travel through a vacuum	transverse wave

[2]

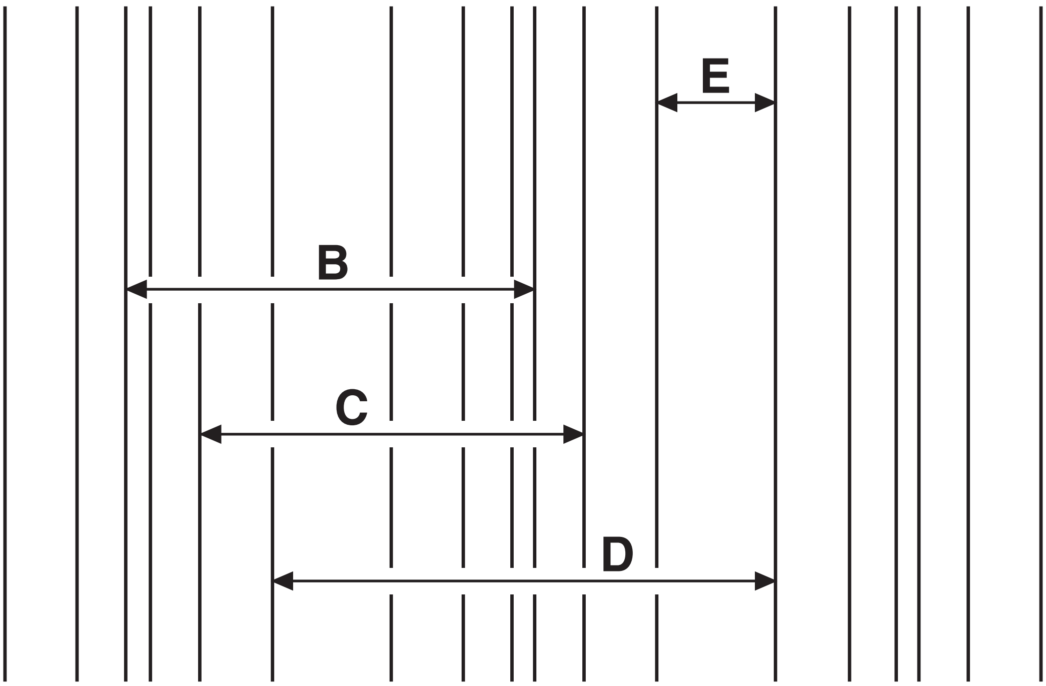
(c) These diagrams show two different types of wave.

(i) Draw a line on this diagram to show the AMPLITUDE. Label it A.



[1]

(ii) One of the arrows, B, C, D or E, shows the wavelength of the wave.



Write down the letter, B, C, D or E, that shows the wavelength.

answer ______________________________ [1]

(d) **Waves are arriving on a beach.**

(i) **What instrument would you need to measure the frequency of the waves?**

Put a ring around the BEST instrument to use.

LASER **OSCILLOSCOPE** **RULER**

SIGNAL GENERATOR **STOPWATCH**

[1]

(ii) **How would you calculate the frequency of the wave?**

Put a ring around the correct equation to use in the calculation.

$$\frac{\text{distance}}{\text{number of waves}}$$

$$\text{distance} \times \text{time}$$

$$\frac{\text{loudness}}{\text{wavelength}}$$

$$\frac{\text{number of waves}}{\text{time}}$$

$$\frac{\text{time}}{\text{distance}}$$

$$\text{wavelength} \times \text{velocity}$$

[1]

[Total: 8]

6 (a) Neil is learning about light and sound waves.

(i) How fast does light travel in space?

Put a (ring) around the correct answer.

30 000 km/s

300 000 km/s

3 000 000 km/s

30 000 000 km/s

[1]

(ii) Neil is comparing sound waves with light waves.

Put a tick (✔) in the boxes to show the properties of sound waves and light waves.

Put one tick (✔) in each row to show whether the property applies to SOUND ONLY, LIGHT ONLY or BOTH SOUND AND LIGHT.

PROPERTY OF WAVE	SOUND ONLY	LIGHT ONLY	BOTH SOUND AND LIGHT
can travel though a vacuum			
needs a solid, liquid or gas to travel through			
can show interference			
can show diffraction			

[3]

(b) Certain applications use particular properties of waves.

Draw a straight line from each APPLICATION to the type of wave used.

Draw another straight line from each TYPE OF WAVE used to the correct WAVE PROPERTY.

You should draw eight lines in total.

APPLICATION	TYPE OF WAVE	WAVE PROPERTY
produce shadow pictures of objects in aircraft passengers' luggage	radio waves	travel through glass without becoming significantly weaker
carry information though optical fibres	X-rays	strongly absorbed by water molecules
heat objects containing water	infrared waves	absorbed by dense materials
carry information for TV programmes	microwaves	not strongly absorbed by the atmosphere

[4]

[Total: 8]

END OF QUESTION PAPER

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