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Monday 21 May 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				

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.
- 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

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

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

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

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

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

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

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

Electric Circuits

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

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

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

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

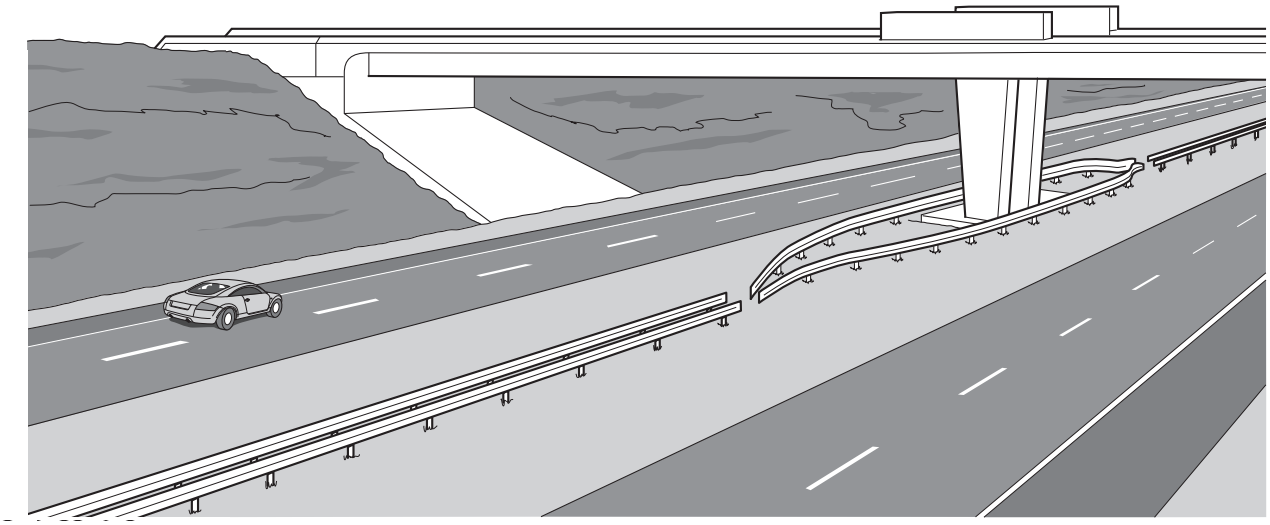
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

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

Answer **all** the questions.

1 A car is travelling along a motorway.



(a) (i) The car takes 100 s to travel 2000 m.
What is its average speed?

Put a (ring) around the correct answer.

0.05 m/s **20 m/s** **1900 m/s** **2100 m/s**

[1]

(ii) Why is the speed described as **average speed**?

It is the average speed of all the cars on the motorway. ☐

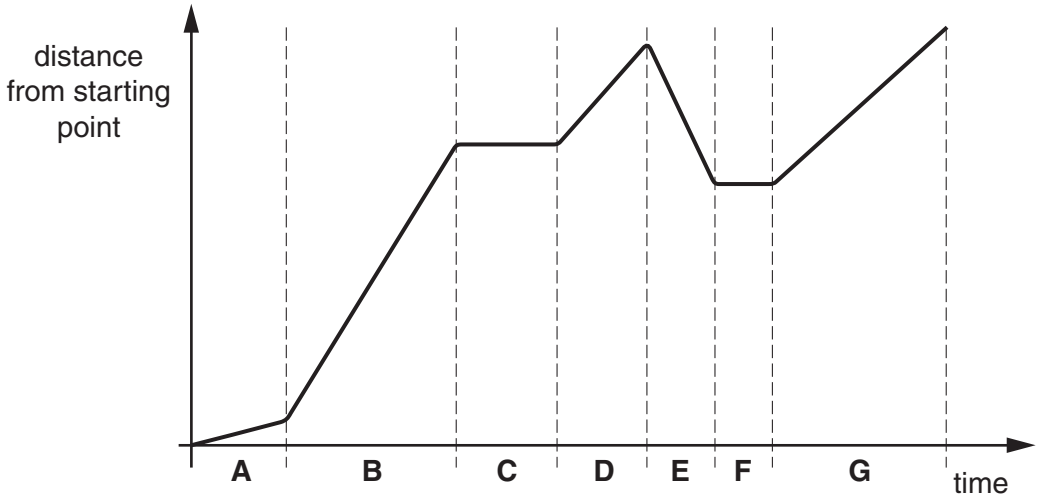
It is calculated using the total time taken and total distance travelled. ☐

It is the only speed that the car travels at on the motorway. ☐

It is the speed that the car's speedometer reads. ☐

[1]

(b) The graph below is a distance-time graph for a car travelling along a straight track.



Some of the following statements are true and some are false.

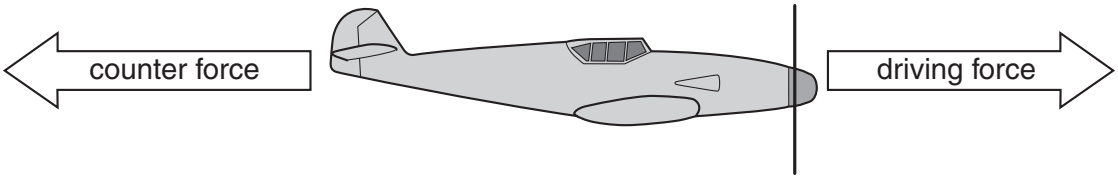
For each statement put a tick (✓) in the correct box to show whether it is **true** or **false**.

	true	**false**
The car is moving fastest in part **A**.	☐	☐
The car came to a complete stop twice.	☐	☐
The speed was constant in part **B**.	☐	☐
The car moved backwards in part **E**.	☐	☐

[2]

[Total: 4]

2 The picture shows a toy plane.
The plane has a motor that pushes it along.
Two of the forces that act on the plane are shown.



Here is some information about the plane at one particular time.

mass	0.5 kg
speed	8 m/s
driving force	10 N
counter force	3 N

(a) Use the information to calculate the momentum of the plane at this time.

momentum = ... unit ..... **[2]**

(b) Use the information to explain why the momentum of the plane increases over the next few seconds.

.....

.....

.....

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

[Total: 4]

3 There are many sports that take place in the Olympics.
All of the sports involve forces.

(a) In cycling, it is important to reduce the amount of resistive force.

Some of the following statements are true and some are false.

For each statement, put a tick (✓) in the correct box to show whether it is **true** or **false**.

	true	**false**
Friction acts in the opposite direction to the movement.	☐	☐
The cyclist leans forward to reduce air resistance.	☐	☐
Air resistance pushes the cyclist forwards.	☐	☐

[2]

(b) In swimming, a backstroke race is started by pushing against the side of the swimming pool.

When one object exerts a force on another, it always experiences a force in return.
Which **two** forces make an interaction pair when a swimmer starts a race?

Put (rings) around the two correct answers.

the swimmer's weight	**the swimmer pushing against the wall**	**friction from the water pushing against the swimmer**
the wall pushing against the swimmer	**the swimmer's gravitational potential energy**	**the kinetic energy of the swimmer**

[1]

(c) A gold medal winner is standing on the podium.

Complete the sentences using words from this list.

down **friction** **hard**

partner **reaction** **up**

When the athlete is standing on the podium, he pushes ..... on the surface.

The surface pushes ..... on the athlete with an equal force.

The force from the surface is called the ..... of the surface.

[1]

[Total: 4]

4 Rob is trying to choose between two different types of walkie talkie.

digital walkie talkie	analogue walkie talkie
	
Great signal over long distances! **Amazing signal quality!**	**Cheap and easy to use!** **Perfect for short distances!**

(a) There are several differences between analogue and digital signals.
Draw **three** lines to join each **description** to the type of **signal** that it describes.

description	**signal**
made from a series of on and off pulses only	digital
signal can vary continuously and may take any value	analogue
it is easier to remove noise from this signal	

[2]

(b) The digital walkie talkie can be used over longer distances than the analogue walkie talkie. It is easier to recreate the original signal using a digital walkie talkie, even if the signal received is poor.
Explain why signals that travel further have a lower quality.
Include in your answer

- what happens to the amplitude of the signal
- what can be picked up by the signal as it travels.

.....

.....

.....

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

(c) All walkie talkies use radio waves.
Which of the following statements about radio waves are true and which are false?
Put a tick (✓) in the correct box next to each statement to show whether it is **true** or **false**.

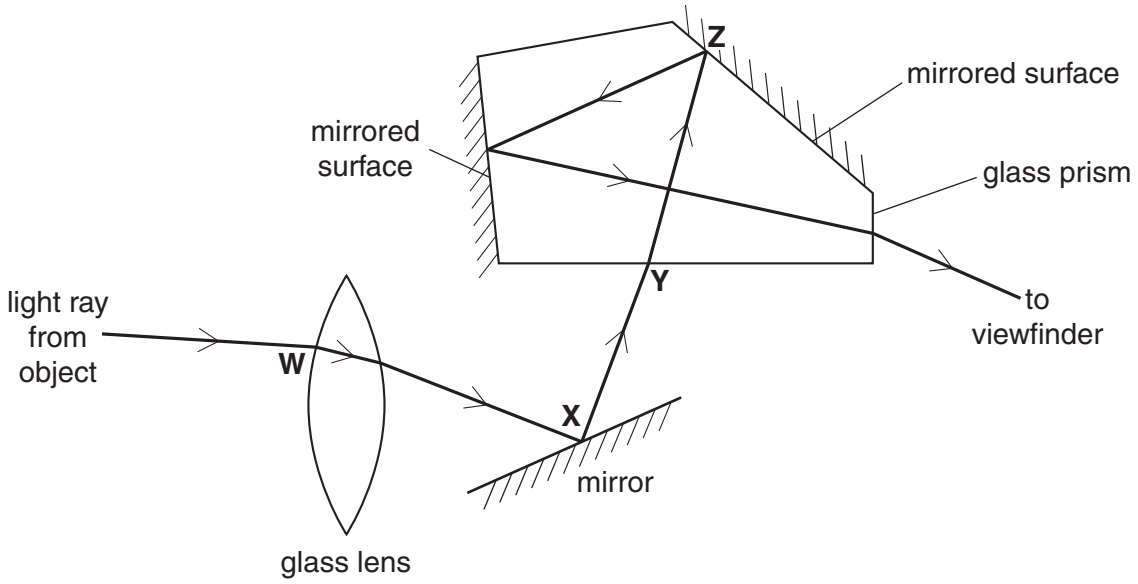
	true	**false**
Radio waves are strongly absorbed by the atmosphere.	☐	☐
Radio waves travel at a very fast speed.	☐	☐
Radio waves are part of the electromagnetic spectrum.	☐	☐
Radio waves have a higher frequency than X-rays.	☐	☐

[2]

[Total: 6]

5 Millie is taking a picture using a camera with a flash.

(a) The diagram shows one path of light through the camera.



(i) When light travels, it can be **reflected** or **refracted**.
These effects happen at various places in the camera.
Which effects happen at locations **W**, **X**, **Y** and **Z** in the diagram?
Put ticks (✓) in the correct boxes.

location	reflection	refraction
W		
X		
Y		
Z		

[3]

(ii) Some effects take place because light changes speed.
Which of the following will cause light to change speed?
Put a tick (✓) in the box next to the correct answer.

light travelling in a straight line through the air	☐
light passing from air into glass	☐
light hitting a mirror and bouncing off	☐

[1]

(b) Millie's camera flash uses part of the electromagnetic spectrum.
Which part of the spectrum does it use?

Put a (ring) around the correct answer.

gamma ray **infrared light** **visible light** **ultraviolet light**

[1]

(c) Millie reads this information about cameras.

> Light enters the camera through a gap that is about 50 mm wide.
> The wavelength of visible light is about 0.000 5 mm.
> This means that the light does not diffract when it enters the camera.

Explain
- what diffraction is
- why light does **not** diffract when it passes through the gap.

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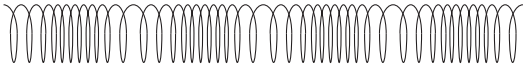
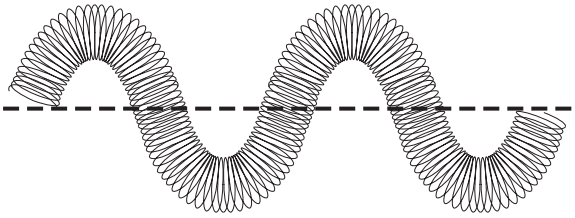
.....

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

[Total: 7]

6 A long spring can be used to demonstrate different types of wave.

wave type A	wave type B
	

(a) Which type of wave is shown in each of the diagrams above?

wave type **A** .....

wave type **B** .....

[1]

(b) (i) Which of the following describes the **wavelength** of wave type **B**?
Put a tick (✓) in the box next to the correct answer.

the distance from one end of the spring to the other end	☐
the distance from the wave crest to the wave trough of the spring	☐
the thickness of the spring	☐
the distance from the first wave crest to the second wave crest	☐
the distance from a wave crest to the dotted line	☐

[1]

(ii) Which of the following describes the **amplitude** of wave type **B**?
Put a tick (✓) in the box next to the correct answer.

the distance from one end of the spring to the other end	☐
the distance from the wave crest to the wave trough of the spring	☐
the thickness of the spring	☐
the distance from the first wave crest to the second wave crest	☐
the distance from a wave crest to the dotted line	☐

[1]

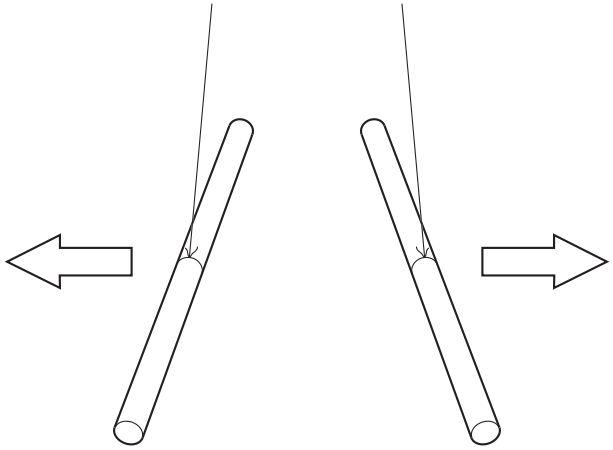
(c) To make wave type **A**, one end of the spring is moved 4 times every second.
The wavelength is 50 cm.
How fast is the wave travelling?
Put a (ring) around the correct answer.

0.5 m/s **2 m/s** **4 m/s** **8 m/s** **200 m/s**

[1]

[Total: 4]

7 George charges two identical plastic rods by rubbing them with a cloth.
He hangs the rods close to each other.
The rods move away from each other.



(a) Explain why the rods move away from each other.
Include in your answer

- what happens when the rods are rubbed with the cloth
- why the rods move away from each other.

.....

.....

.....

.....

..... **[3]**

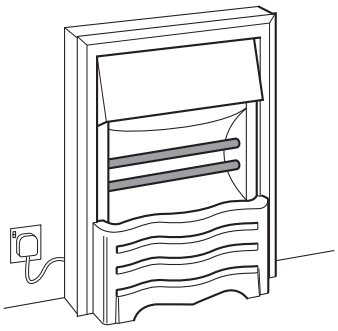
(b) George repeats the experiment with metal rods.
The rods do not move.
Join two boxes to make a sentence that helps to explain why the rods do not move.
You should draw **one** straight line.

Metal rods contain lots of charges…	…which can not move.
Metal rods contain few charges…	…which are free to move.
Metal rods contain no charges…	…which move only when connected to a battery.

[1]

[Total: 4]

8 Ella buys a new electric heater.



(a) The bars in the heater act as resistors.
Complete the sentence to explain why.
Use a word from this list.

current **resistance** **voltage**

Resistors get hot when ..... passes through them. **[1]**

(b) Ella plugs the heater into the mains electricity supply.

(i) What is the voltage of the mains supply in our homes?

Put a (ring) around the correct answer.

1.5V **12V** **110V** **230V** **[1]**

(ii) The heater uses a current of 10 A.
What is the total resistance of the circuit?
Show your calculation.

resistance = ... ohms **[2]**

(c) Ella is worried that using the heater is going to cost her a lot of money.
The average power of the heater is 2.3 kW.
How much would it cost Ella to use the heater for 2 hours?
The cost for one kilowatt-hour is 20p.

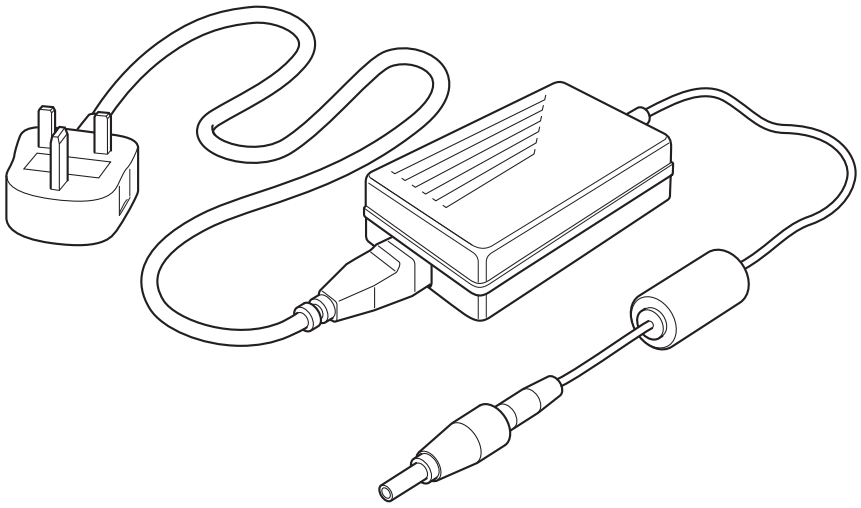
cost = ... p **[1]**

(d) Ella wants to make a model of the heater, but does not want it to get too hot.
She uses a thermistor in her circuit.
Draw the circuit symbol for a thermistor in the space between the pieces of wire below.

[1]

[Total: 6]

9 Vikram's laptop computer has a large device in its charging cable.



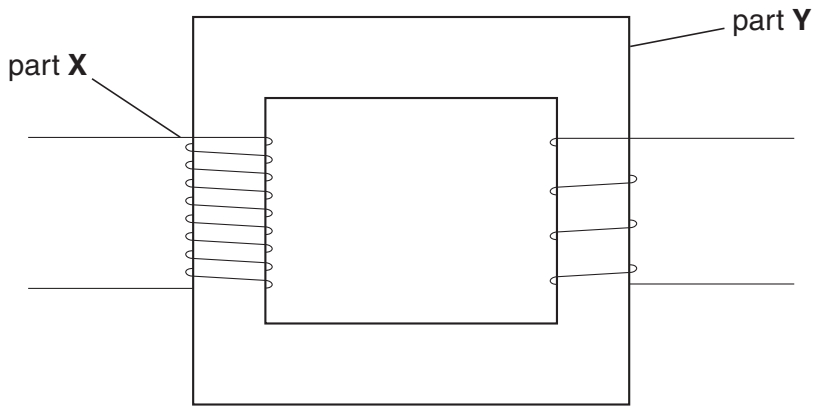
(a) The device contains a component which changes the voltage from mains voltage to a smaller one that can be used by the laptop.
What is the name of this device?

Put a (ring) around the correct answer.

generator **LDR** **transformer** **voltmeter** **[1]**

Question 9 continues on page 16

(b) The diagram below shows a simplified construction of this component.



What is part **X** and what is part **Y**?
Draw **two** lines to match each **part** to its correct **description**.

part	description
	iron core
part **X**	aluminium core
	steel core
part **Y**	coil of thread
	coil of copper wire

[2]

[Total: 3]

END OF QUESTION PAPER