CAMBRIDGE
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GCSE

Physics A

Session: 2010 June
Type: Question paper
Code: J635
Units: A331; A332; A333

OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE
PHYSICS A

A331/01

Unit 1: Modules P1 P2 P3 (Foundation Tier)

OCE/15621

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)

Thursday 24 June 2010
Afternoon

Duration: 40 minutes

A331 01

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. 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**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Read the statements about asteroids.

Statements describing data may be true or false.

A All asteroids stay in fixed orbits around the Sun, between Mars and Jupiter.

B I think that the dinosaurs were wiped out when an asteroid hit the Earth.

C A large asteroid hitting the ocean causes a tsunami.

D There is less chance of the Earth being hit by a big asteroid than a small asteroid.

E There are many more small asteroids than large asteroids.

Write down the correct letters, **A**, **B**, **C**, **D** or **E**, to answer the following questions.

(a) Which **three** statements describe data or observations about asteroids?

statements ..... , ... and ..... **[1]**

(b) Which statement supports statement **D**?

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

(c) Which statement disagrees with statement **B**?

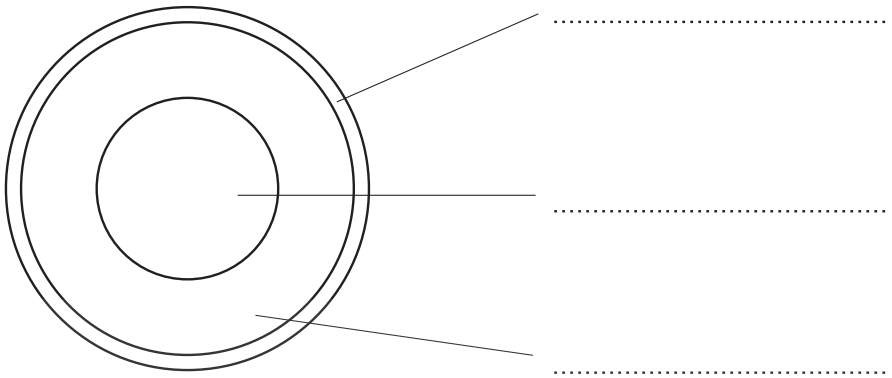
statement ..... **[1]**

(d) Which data statement suggests asteroids can be hazardous?

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

[Total: 4]

2 **(a)** Complete the labels on the diagram of the Earth.



[3]

(b) Put the following in order of age.

A the Earth

B the Earth's oldest rocks

C the Solar System

oldest | | | | youngest

[1]

(c) Complete the following sentence about the Sun.

Use words from this list.

galaxy **planet** **solar system** **star** **universe**

The Sun is a ..... in the Milky Way..... . **[2]**

[Total: 6]

3

The following statements are all true.

A All elements except hydrogen are made in stars.

B Hydrogen, helium and lithium were formed in the big bang.

C When a star dies most of it is blown into space.

D Hydrogen and helium are the lightest elements.

E The solar system formed from gas clouds in space.

F Most stars are older than the Sun.

A scientist says, "We are all made from elements like carbon and oxygen, so we are all made from stardust."

(a) Which **three** statements, **A**, **B**, **C**, **D**, **E** or **F**, provide an explanation for what the scientist says?

statements ..... , ... and ..... **[3]**

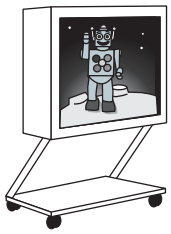
(b) Another scientist says, "All elements heavier than helium were only made in stars."

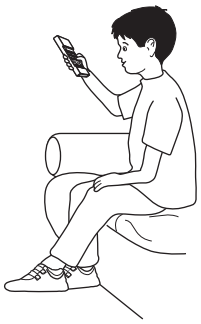
Which statement, **A**, **B**, **C**, **D**, **E** or **F**, disagrees with what this scientist says?

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

[Total: 4]

4





John discovers that the remote control for his TV works when he points it at the ceiling halfway between him and the TV.

(a) Complete the sentences in the explanation.

Use words from this list.

absorbs **emits** **reflects** **refracts**

The remote control ..... radiation.

The radiation ..... from the ceiling.

The receiver in the TV ..... the radiation. **[3]**

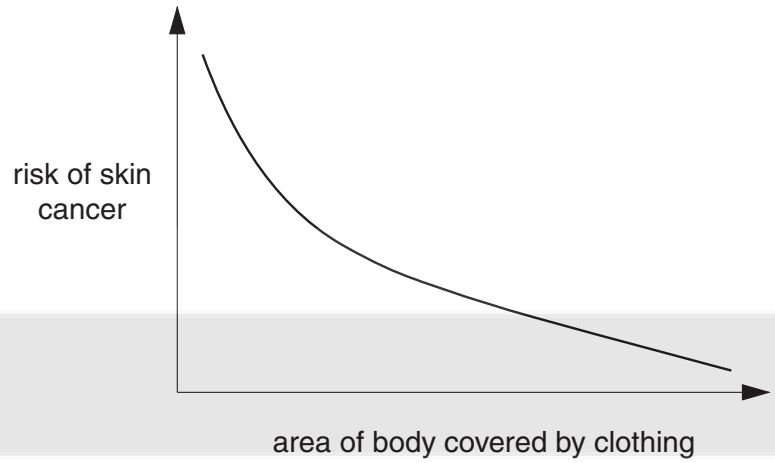
(b) What type of electromagnetic radiation does the remote control transmit to the TV?

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

[Total: 4]

5 Scientists often discover correlations between factors and outcomes.

(a) Look at the graph.



Describe the correlation shown by the graph.

.....

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

(b) Describe a different example of a correlation from everyday life.

.....

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

[Total: 4]

6 People often confuse the greenhouse effect with holes in the ozone layer.

Complete the two sentences below.

Use words from this list.

cancer **carbon dioxide** **clouds** **global warming** **infrared** **ultraviolet**

The greenhouse effect is caused by ..... in the atmosphere which can lead to ..... .

The ozone layer absorbs ..... radiation which can cause ..... . **[4]**

[Total: 4]

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7 The properties of microwaves mean that they are used for many purposes.

(a) Which of the following statements about microwaves are true?

Put ticks (✓) in the boxes next to each **correct** statement.

Microwaves heat by causing particles to vibrate.	☐
Microwaves are ionising radiation.	☐
The screen on a microwave oven lets light through but blocks microwaves.	☐
Mobile phones produce microwaves.	☐
Microwaves are blocked by the ozone layer.	☐
The higher the intensity of microwaves in a microwave oven the less the food is heated.	☐

[3]

(b) Susie sunbathes on the beach.

Her mum tells her to put on sun cream.

Put a tick (✓) in the box next to the correct explanation for using sun cream.

Sun cream will keep her skin from getting hot.	☐
Sun cream will reflect or absorb ionising radiation from the Sun.	☐
Sun cream will transmit ionising radiation from the Sun.	☐
Sun cream will stop her skin from getting cold.	☐

[1]

[Total: 4]

8 Joe has been told he has cancer.

He reads an article about a new drug.

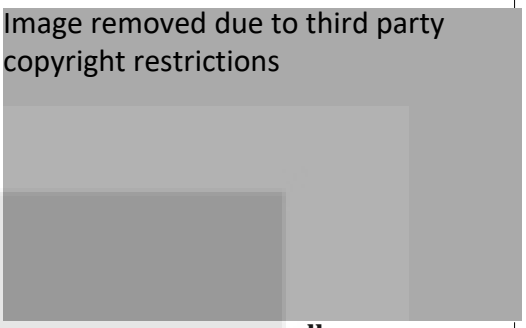
New drug can protect healthy cells from radiation

The radiation used to kill cancer cells also causes some damage to healthy cells.

Scientists experimenting with rats have made a discovery that could improve the effectiveness of radiation therapy.

Damaged cells kill themselves through a process known as apoptosis. The new drug stops the cells killing themselves. The researchers found no sign of side effects in laboratory tests on rats.

Protecting healthy cells against the effects of radiation may allow cancer patients to receive higher doses of radiotherapy, or longer courses of treatment.



cancer cell

(a) This drug may allow higher doses of radiation to be used in treating cancer patients.

Who would make new **regulations** to control the acceptable radiation dose?

Put a (ring) around the correct answer.

government officials **nurses** **patients** **physicists**

[1]

(b) Suggest a possible benefit and a possible risk for Joe if he used this new drug.

.....

.....

.....

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

(c) The drug works by stopping **apoptosis** in cells.

What does the article say apoptosis means?

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

cells being damaged	☐
cells becoming cancer cells	☐
cells killing themselves	☐
cells becoming radioactive	☐

[1]

[Total: 4]

9 The table shows what will stop different types of ionising radiation.

(a) Complete the table with the names of the three types of ionising radiation emitted by radioactive materials in the correct spaces.

type of ionising radiation	stopped by		
	paper	aluminium	lead
.....		✓	✓
.....			✓
.....	✓	✓	✓

[3]

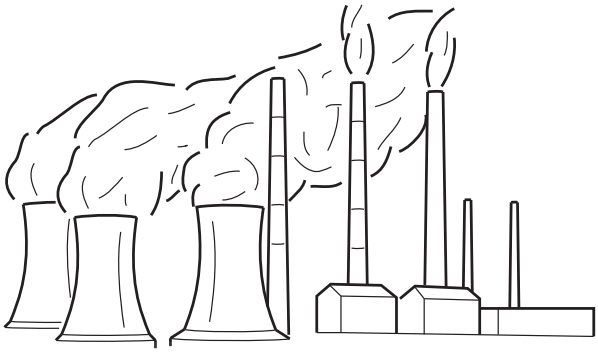
(b) The ionising radiation used to treat a cancer must penetrate to the cancer cells in the middle of the body.

Which is the best type of ionising radiation to use?

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

[Total: 4]

10



(a) The government is planning to build a new power station.
The table gives some information about three different types of power station.

type of power station	efficiency	cost per kWh in pence	environmental factors
coal	38%	2 to 3	produces carbon dioxide
nuclear	34%	2 to 2.5	produces radioactive waste
wind	35%	4 to 5.5	may damage local wildlife e.g. birds

Which type of power station would you recommend building?

Explain your choice.

Use information from the table to decide.

.....

.....

.....

.....

.....

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

(b) Explain why electricity is described as a **secondary** energy source.

.....

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

[Total: 4]

END OF QUESTION PAPER

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A331/02

PHYSICS A

Unit 1: Modules P1 P2 P3 (Higher Tier)

OCE/15627

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)

Thursday 24 June 2010
Afternoon

Duration: 40 minutes

A331102

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.
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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**.
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

1

The following statements are all true.

A All elements except hydrogen are made in stars.

B Hydrogen, helium and lithium were formed in the big bang.

C When a star dies most of it is blown into space.

D Hydrogen and helium are the lightest elements.

E The solar system formed from gas clouds in space.

F Most stars are older than the Sun.

A scientist says, "We are all made from elements like carbon and oxygen, so we are all made from stardust."

(a) Which **three** statements, **A**, **B**, **C**, **D**, **E** or **F**, provide an explanation for what the scientist says?

statements ..... , ... and ..... **[3]**

(b) Another scientist says, "All elements heavier than helium were only made in stars."

Which statement, **A**, **B**, **C**, **D**, **E** or **F**, disagrees with what this scientist says?

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

[Total: 4]

2 This graph shows the results of Edwin Hubble's research into galaxies, published in 1929.

(a) Which statements correctly describe what the graph shows?

Put a tick (✓) in the boxes next to the correct answers.

As distance from Earth increases the speed of galaxies increases. ☐

As distance from Earth decreases the speed of galaxies increases. ☐

Speed of galaxies and distance from Earth are inversely related. ☐

Galaxies are moving. ☐

As distance from Earth increases the speed of galaxies decreases. ☐

[2]

(b) Which statement best **explains** the results in the graph?

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

Gravity is acting on the galaxies. ☐

Space is expanding. ☐

Hubble discovered the relationship. ☐

There are too many galaxies in the universe. ☐

[1]

(c) The data in the graph provides one piece of evidence for which of the following explanations?

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

Life must exist on other planets.	☐
Galaxies are made up of stars.	☐
The universe is orbiting our galaxy.	☐
Stars have a life cycle.	☐
The universe started with a 'big bang'.	☐

[1]

(d) Approximately how many years old is the universe?

Put a (ring) around the correct answer.

14 million **14 hundred million** **14 thousand million** **14 hundred billion**

[1]

[Total: 5]

3 Wegener's theory of continental drift was not really accepted until plate tectonics explained how the continents could move.

(a) Wegener's theory of continental drift was based on comparisons between different continents.

Which of the following comparisons did Wegener use as evidence for his theory?

Put a (ring) around the correct answers.

climate

fossils

records on stone tablets

rivers

rock types

[2]

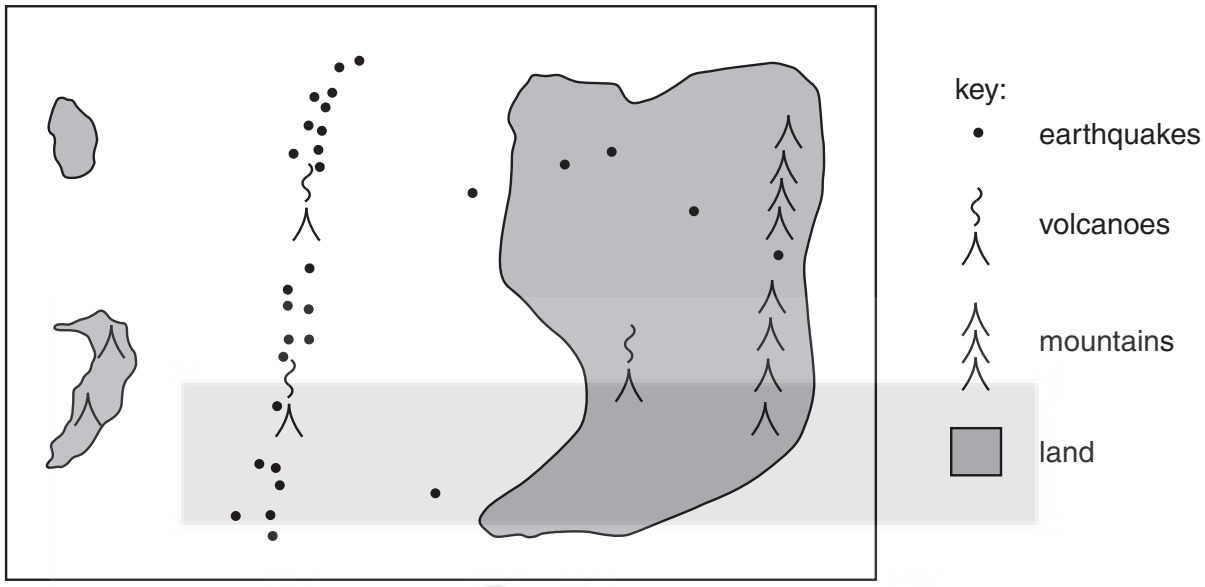
(b) Which of the following are correct statements about Wegener's theory of continental drift?

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

The theory linked things previously thought unrelated.	☐
Mountains formed as the Earth cooled.	☐
His observations could not be replicated by other scientists.	☐
The evidence did not prove his theory correct.	☐
He predicted a symmetrical pattern of sea floor magnetism.	☐

[2]

(c) Look at the map of part of an ocean and the key.



(i) On the map draw lines to show the most likely position of plate boundaries. **[2]**

(ii) On the map draw an arrow to show the direction of movement of one plate. **[1]**

[Total: 7]

4 The properties of microwaves mean that they are used for many purposes.

(a) Which of the following statements about microwaves are true?

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[3]

(b) Susie sunbathes on the beach.

Her mum tells her to put on sun cream.

Put a tick (✓) in the box next to the correct explanation for using sun cream.

Sun cream will keep her skin from getting hot.	☐
Sun cream will reflect or absorb ionising radiation from the Sun.	☐
Sun cream will transmit ionising radiation from the Sun.	☐
Sun cream will stop her skin from getting cold.	☐

[1]

[Total: 4]

5 People often confuse the greenhouse effect with holes in the ozone layer.

(a) Put one tick (✓) in each row to show whether each phrase relates to the **greenhouse effect**, **holes in the ozone layer** or **both**.

	greenhouse effect	**holes in the ozone layer**	**both**
skin cancers			
electromagnetic radiation			
reversible chemical changes in the atmosphere			

[3]

(b) Which two processes in living organisms have the most effect on carbon dioxide in the atmosphere?

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

[Total: 5]

6 Scientists often discover correlations between factors and outcomes.

Sometimes they think that a change in one factor causes a change in an outcome.

Give an example of a correlation that does **not** have a causal link.

Your example should relate either to health risks and radiation or to global warming.

Use this example to explain the difference between a correlation and a cause.

.....

.....

.....

.....

.....

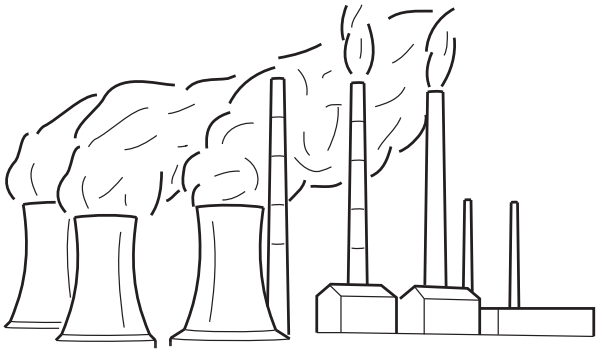
.....

.....

..... **[4]**

[Total: 4]

7



(a) The government is planning to build a new power station.
The table gives some information about three different types of power station.

type of power station	efficiency	cost per kWh in pence	environmental factors
coal	38%	2 to 3	produces carbon dioxide
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wind	35%	4 to 5.5	may damage local wildlife e.g. birds

Which type of power station would you recommend building?

Explain your choice.

Use information from the table to decide.

.....

.....

.....

.....

.....

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

(b) Explain why electricity is described as a **secondary** energy source.

.....

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

[Total: 4]

8 Read the article about a new drug.

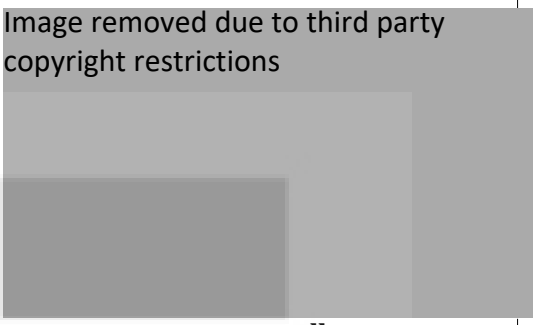
New drug can protect healthy cells from radiation

Scientists have found a drug which can protect healthy cells from radiation. The discovery could improve the effectiveness of radiation therapy in treating cancer. Radiotherapy is an important tool in the fight against cancer.

The radiation causes damage to healthy cells. Damaged cells kill themselves through a process known as apoptosis. The body uses this process to stop damaged cells from multiplying; cancer cells survive by turning off the apoptosis mechanism. One risk of preventing cell death is that defective cells may be allowed to survive which could then turn cancerous.

However, the researchers found no sign of this happening in laboratory tests on rats.

Protecting healthy cells against the effects of radiation may allow cancer patients to receive higher doses of radiotherapy, or longer courses of treatment.



cancer cell

(a) Explain how radiation therapy damages cells.

.....

.....

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

(b) Use information in the article to explain what is meant by apoptosis.

.....

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

(c) Who will decide when the drug is ready to be used on human patients?

Put a (ring) around the correct answer.

doctors **government officials** **patients** **physicists**

[1]

[Total: 4]

9 Uranium is used in nuclear power stations.

Uranium-238 has 92 protons and 146 neutrons in its nucleus.

Uranium emits alpha particles.

An alpha particle is made up of 2 protons and 2 neutrons.

(a) In 13.38 billion years the activity of uranium-238 drops to one eighth of the original amount.

(i) How many half-lives does this take?

Put a (ring) around the correct answer.

1/4 **7/8** **3** **7** **8**

[1]

(ii) What is the half-life of uranium-238?

half-life = ... **[1]**

(b) When a uranium-238 atom emits an alpha particle it changes into a thorium atom.

$$^{238}_{92}U \rightarrow Th + \alpha$$

How many protons, neutrons and electrons are **in the nucleus** of the thorium atom?

protons .....

neutrons .....

electrons .....

[3]

[Total: 5]

END OF QUESTION PAPER

OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A332/01

Unit 2: Modules P4 P5 P6 (Foundation Tier)

OCE/15665

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)

Wednesday 26 May 2010
Morning

Duration: 40 minutes

A332 01

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

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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

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

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Question 1 starts on page 4

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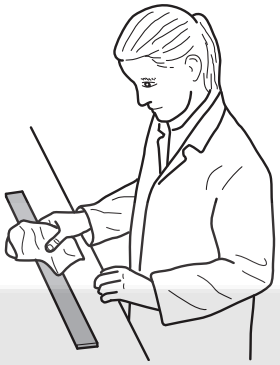
Answer **all** the questions.

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]

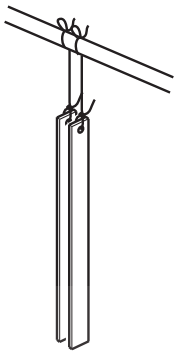
(ii) What charge does the **duster** gain, by charging the rod?

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 **not** 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 This question is about mains electricity.

(a) (i) Use the correct word from the list to complete the sentences about mains electricity.

Each word may only be used once or not at all.

alternating **battery** **direct** **electromagnetic** **generator** **motor**

Mains electricity is produced by a machine called a ……..…..……. .

The voltage is produced by a process called ……..…… induction.

The current produced is called ……..…… current. **[3]**

(ii) What is the voltage of the mains supply to our homes?

answer .....volts **[1]**

(iii) The voltage produced in power stations is much larger than the voltage supply to your home.

Which device is used to change the size of the voltage?

Put a (ring) around the correct answer.

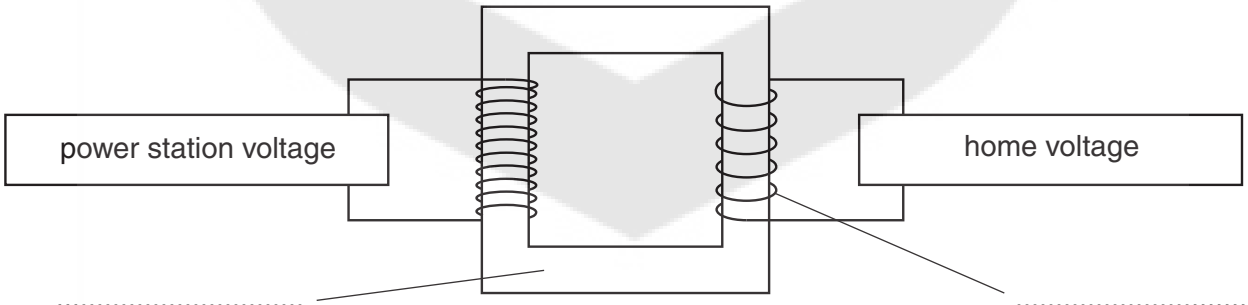
fuse **generator** **transformer** **transmission line**

[1]

(iv) Label the diagram of the device that changes the voltage.

Use words from this list.

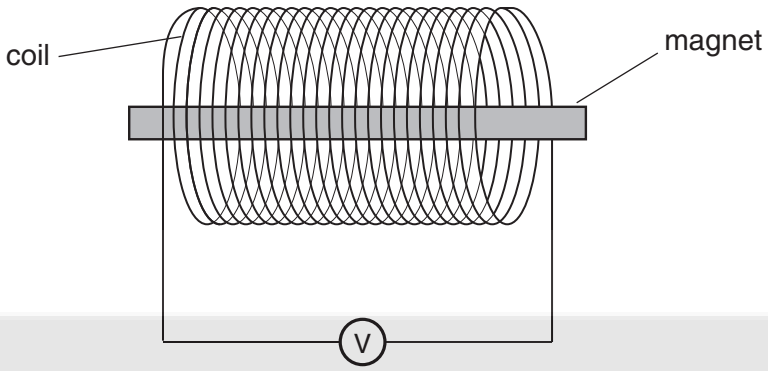
coil of wire **core** **switch** **wave**



[2]

(b) Edwin makes a model to show how a power station produces mains electricity.

He uses a magnet and a coil of wire.



(i) What does Edwin do to produce a voltage?

.....

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

(ii) Edwin wants a larger voltage output from the model.

Place a tick (✓) next to the **two** changes he should make.

increase the number of coils	☐
use different coloured wire	☐
use a stronger magnet	☐
use a weaker magnet	☐
use a larger voltmeter	☐

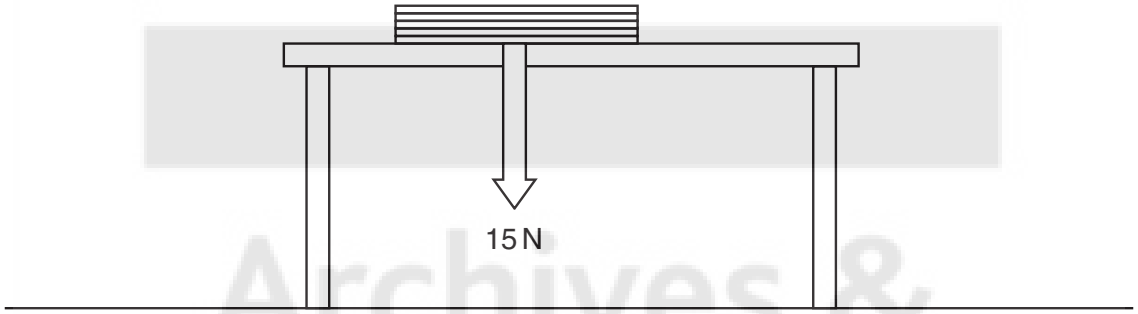
[2]

[Total: 10]

3 Laura's class are discussing forces.

(a) The diagram shows the force of a book acting on a table.

(i) Add an arrow to show the force of the table acting on the book. **[1]**



(ii) What is the value of the force of the table acting on the book?

answer .....N **[1]**

(iii) Choose the best phrase to complete the sentence.

a charged **an interaction** **a magnetic** **an unbalanced**

These two forces are an example of …… pair. **[1]**

(b) Laura now pushes the book across the table.

(i) Describe the force between the book and the table as she pushes it.

You should include:

- the name of the force between the book and the table
- the direction this force acts compared to the direction the book moves.

.....

.....

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

(ii) The book moved 1.5 m across the table.

The average force Laura used was 6 N.

Calculate the work done by this force.

You should show your working. Use an equation from page 2.

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

(iii) Laura's pushing force is bigger than the force between the book and the table.

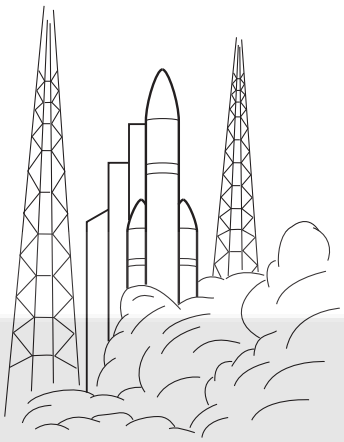
What happens to the momentum of the book as Laura pushes it across the table?

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

[Total: 8]

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

It lifted a mass of 10 tonnes.



(a) The rocket produces a force of 13 000 kN at launch.

This is 20 times as much as a jumbo jet.

What is the force produced by a jumbo jet in kN?

Put a (ring) around the correct calculation.

13 000 + 20 **13 000 – 20** **13 000 × 20** $\frac{\textbf{13 000}}{\textbf{20}}$

[1]

(b) 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]**

(c) 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]**

[Total: 5]

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]

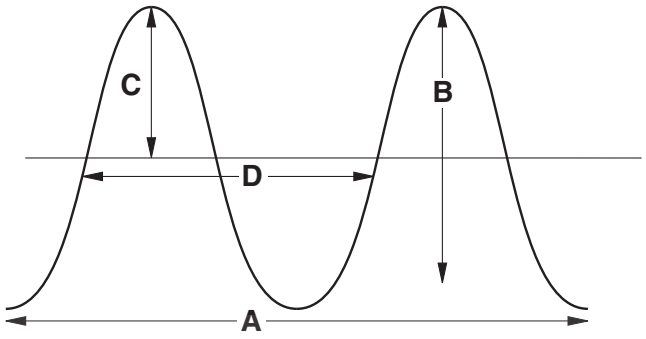
(b) Waves are either **longitudinal** or **transverse**.

Draw a straight line from each **description** to the correct **type of wave**.

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

[2]

(c) Here is a diagram of one type of wave.



(i) Which label, **A**, **B**, **C** or **D**, shows the **amplitude** of the wave?

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

(ii) Which label, **A**, **B**, **C** or **D**, shows the **wavelength** of the wave?

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

(d) The frequency of a wave is 5 hertz (Hz).

(i) Explain what 5 Hz means.

.....

.....

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

(ii) The wavelength of the 5 Hz wave is 10 m.

Calculate the **speed** of the wave.

Use the correct equation from page 2.

answer = ... m/s **[1]**

[Total: 9]

6 Simon is listening to FM radio. His dad tells him that FM stands for Frequency Modulation.

Some other radio stations use AM to transmit signals.

(a) What does AM stand for?

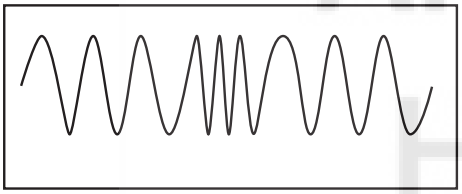
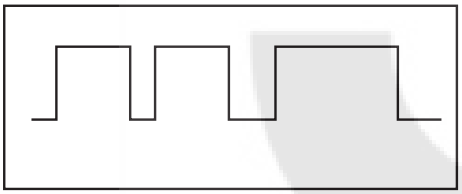
Put a tick (✓) in the box next to the correct answer.

amateur modulation	☐
american modulation	☐
amplitude modulation	☐
analogue modulation	☐

[1]

(b) Most radio stations are now switching to digital signals.

(i) Draw a straight line from each **signal shape** to its correct **signal name**.

signal shape	**signal name**
	digital signal
	AM signal
	FM signal

[2]

(ii) When any signal travels it picks up **noise**.

The digital signals can be cleaned up by the receiver to remove the noise.

What is meant by noise in a signal?

.....

.....

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

[Total: 4]

END OF QUESTION PAPER

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OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A332/02

Unit 2: Modules P4 P5 P6 (Higher Tier)

OCE/15691

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)

Wednesday 26 May 2010
Morning

Duration: 40 minutes

A332/02

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. 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 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

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

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Question 1 starts on page 4

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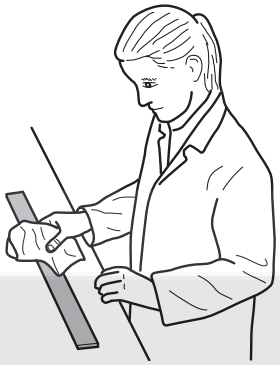
Answer **all** the questions.

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]

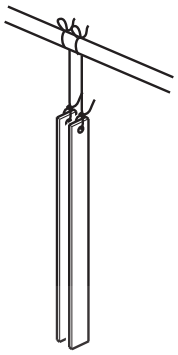
(ii) What charge does the **duster** gain, by charging the rod?

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 **not** 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. ☐

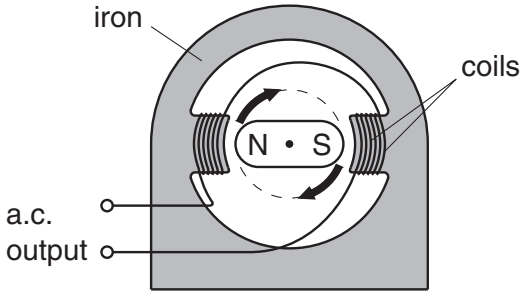
… they have lots of free electrons that can move. ☐

… 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. ☐

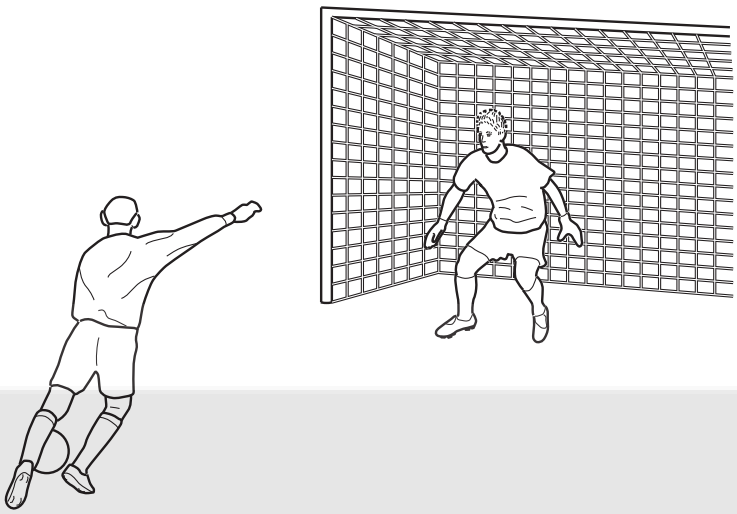
… used in more appliances. ☐

… 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**.

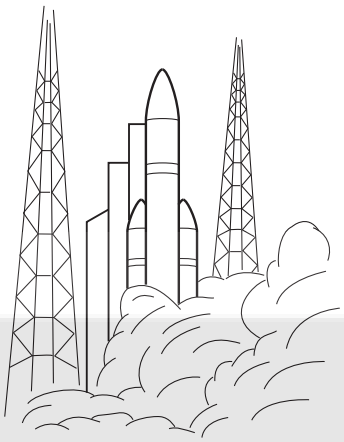
reason for the air bag	**effect**	**result**
air bag increases the time taken for Ian's head to stop	the change of momentum takes place more slowly	the force on Ian's head increases
air bag inflates slowly	the change of momentum takes place more quickly	the force on Ian's head stays the same
air bag 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 **longitudinal** or **transverse**.

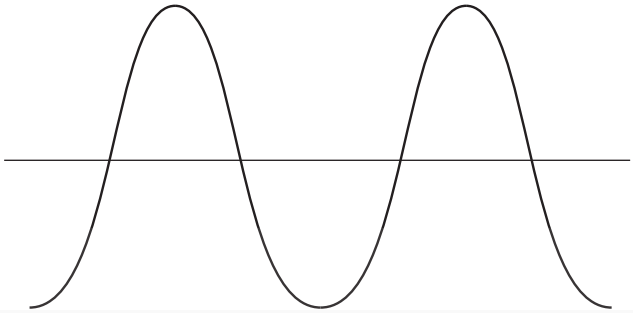
Draw a straight line from each **description** to the correct **type of wave**.

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

[2]

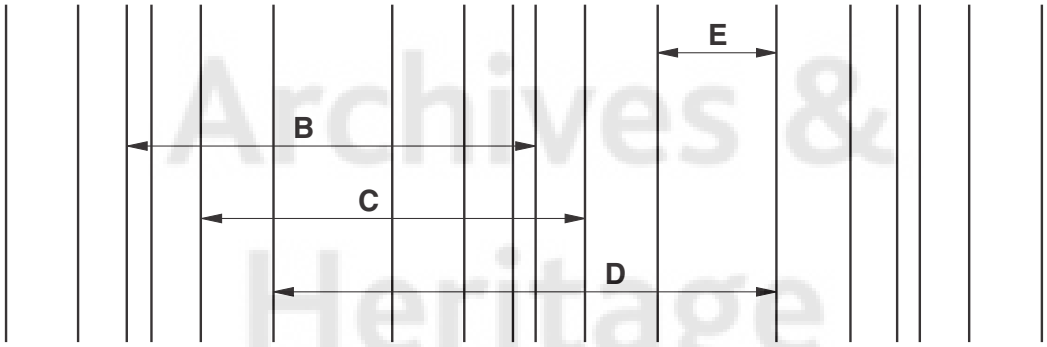
(c) These diagrams show two different types of wave.

(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.

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

distance × time

$$\frac{\textbf{loudness}}{\textbf{wavelength}}$$

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

$$\frac{\textbf{time}}{\textbf{distance}}$$

wavelength × 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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RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A333/01

Unit 3: Ideas in Context plus P7 (Foundation Tier)

OCE/16032

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

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Wednesday 9 June 2010
Afternoon

Duration: 60 minutes

A333301

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. 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 **55**.
- A list of physics equations is printed on page 2.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- 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

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

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

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

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

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

The Wave Model of Radiation

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

Further Physics, Observing the Universe

$$\text{lens power} = \frac{1}{\text{focal length}}$$

$$\text{magnification} = \frac{\text{focal length of objective lens}}{\text{focal length of eyepiece lens}}$$

$$\text{speed of recession} = \text{Hubble constant} \times \text{distance}$$

Answer **all** the questions.

This question is based on the article 'Climate 'fix' could deplete ozone'.

1 **(a)** The article says that 'the bad side is definitely the ozone depletion'.

The sentences below explain why ozone depletion is 'bad'.

Use words from the list to complete the sentences.

absorbs **damages** **less** **lets through** **more** **only**

Ozone in the atmosphere …… ultraviolet radiation.

Less ozone means …… ultraviolet radiation reaches the surface of the Earth.

Ultraviolet radiation often …… living cells.

[3]

(b) Many people get confused between 'holes in the ozone layer' and 'the greenhouse effect'.

Complete the table to show the differences.

	main gas involved	**effect**
holes in the ozone layer	ozone	too much ultraviolet is a hazard to living organisms
the greenhouse effect		

[2]

(c) The article suggests that there is a correlation between an increase of sulfate particles in the upper atmosphere and a lowering of the Earth's temperature.

(i) What evidence is given in the article to support the idea that sulfate particles might cool the Earth?

.....

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

(ii) Give a different example of a correlation between two things, **taken from the article**.

.....

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

(d) Suggest two ways that climate change can cause problems.

1 .....

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

(e) In the article, Dr Tilmes says '… to make decisions you need to know what is good about it and what is bad about it.'

(i) In what situation might it be a good idea to use the sulfate particles to cool the planet?

Your answer should include

- a risk
- a benefit
- the situation when the benefit might outweigh the risk.

.....

.....

.....

.....

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

(ii) If the sulfate particles are used in the upper atmosphere, this can increase the risk to people.

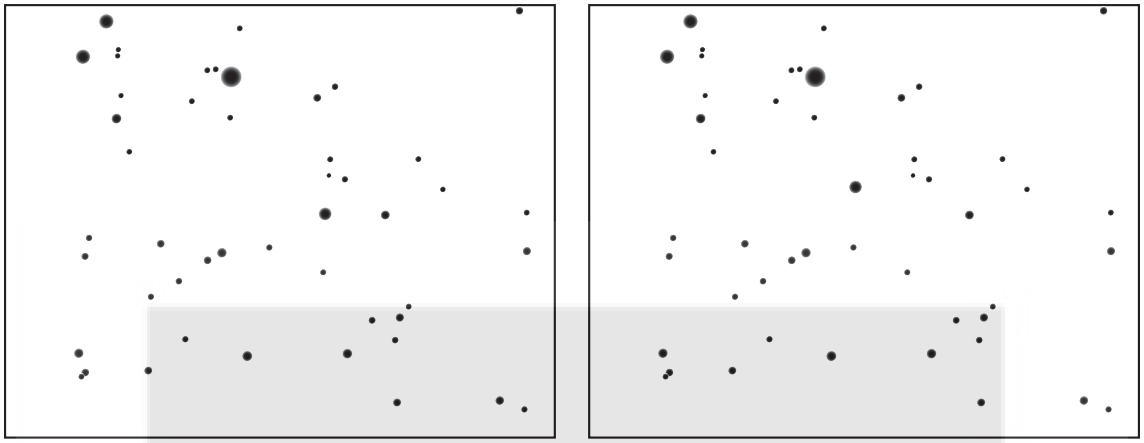
Suggest one thing that individuals could do to reduce the risk to themselves.

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

[Total: 14]

2 Angie is taking photos of the night sky.

Here are two of her pictures.



23rd July 2009 28th July 2009

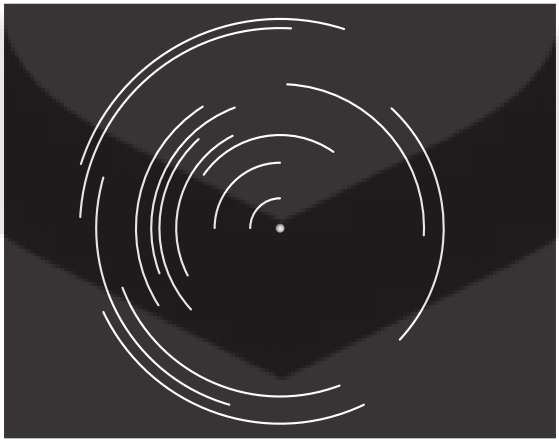
(a) **(i)** Clearly label the planet on one of the pictures. **[1]**

(ii) Suggest why the Ancient Greeks called the planets 'wandering stars'.

.....

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

(b) Angie points her telescope and camera at the pole star and takes a photograph over a few hours.



(i) Explain why most of the stars appear as lines in the photograph.

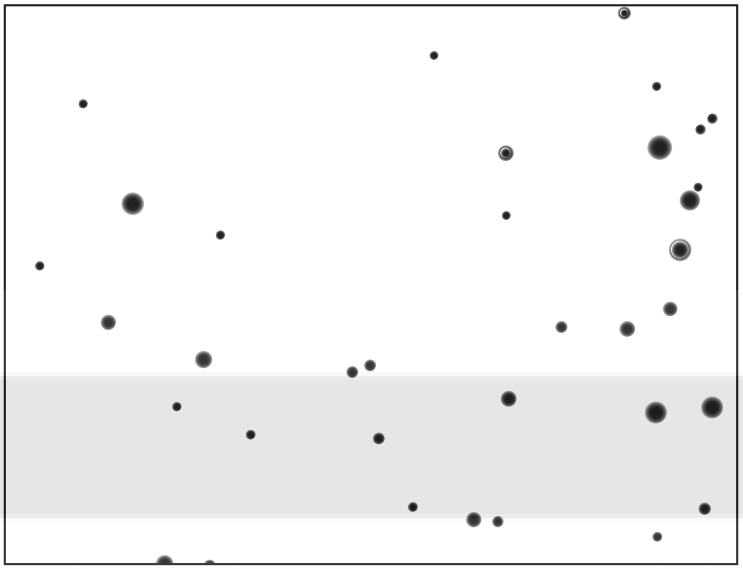
.....

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

(ii) For how long was the camera taking the photograph, to the nearest hour?

answer ..... hours **[1]**

(c) Angie takes a picture of the sky six months later at the same time of night.



23rd January 2010

Why are different stars seen in the picture?

You may use a diagram to help in your explanation.

.....

.....

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

(d) A solar day is the time it takes for the Sun to move once across the sky.

A sidereal day is the time it takes for the Earth to rotate once on its axis.

Explain why the solar day is longer than the sidereal day.

.....

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

(e) Angie wants to look at the Andromeda galaxy.

She looks up its position using the internet:

altitude: +32 deg 20 min
azimuth: +11 deg 12 min

Explain how these numbers help Angie find the Andromeda galaxy in the sky.

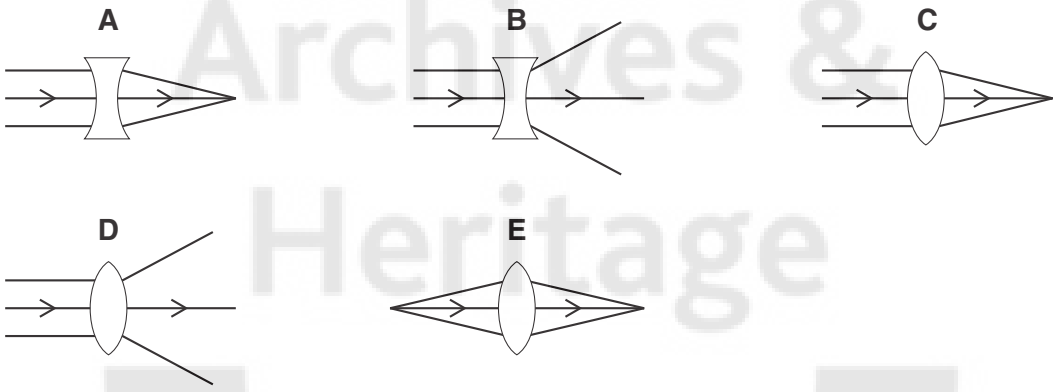
.....

.....

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

(f) **(i)** Angie focuses her telescope on a very distant star.

The light from the star passes through the objective lens of the telescope.



Which diagram, **A**, **B**, **C**, **D** or **E**, correctly shows the light passing through the lens?

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

(ii) Angie's telescope is at the bottom of her garden.

She wants to control it and view the images on her computer in her bedroom.

What advantages will Angie get from using a computer to remotely control her telescope?

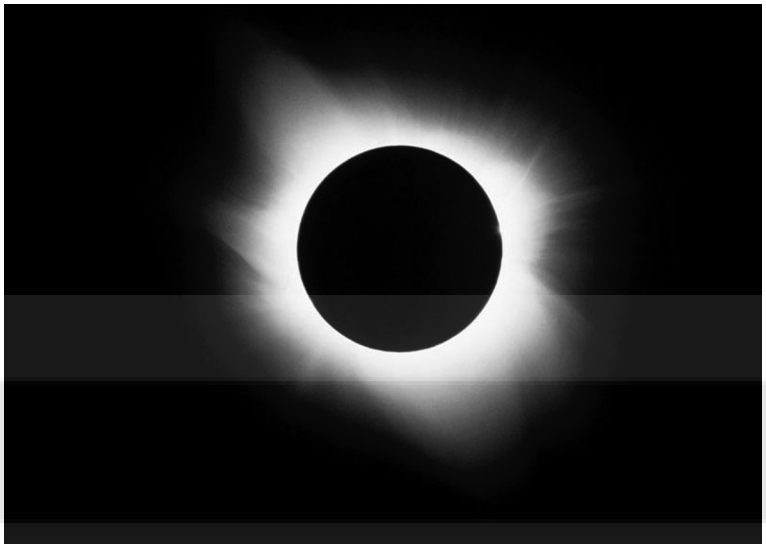
.....

.....

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

[Total: 13]

3 This is a picture of a solar eclipse.



Explain how a solar eclipse happens.

You should draw a diagram to help.

.....

.....

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

[Total: 3]

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Question 4 begins on page 10

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4 Fred is a lens maker.

Here are the properties of some lenses Fred made.

lens	diameter in cm	power in D	focal length in m
W	4	10	0.1
X	5	1	1
Y	10	0.67	1.5
Z	7		0.8

(a) (i) Lenses **W**, **X** and **Y** are made from the same type of glass.

Which lens has the most curved surface?

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

(ii) Calculate the power of lens **Z**.

power = ... unit ..... **[3]**

(iii) Fred is building a telescope to observe **very faint** stars.

He chooses lens **Y** as the objective lens that collects the light.

Put ticks (✓) in the boxes next to the **two** sentences that best explain why he chooses lens **Y**.

Lens **Y** has the largest diameter. ☐

Lens **Y** has the longest focal length. ☐

Lens **Y** is the most powerful. ☐

Lens **Y** will collect the most light. ☐

[2]

(b) Fred makes a telescope that only uses lenses.

What is the smallest number of lenses that he must use?

number of lenses = ... **[1]**

(c) Fred also makes telescopes that do not use a lens to collect the light.

These are called reflectors.

What is used to collect the light?

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

[Total: 8]

5 All the information we have about stars comes from the electromagnetic waves we receive from the stars.

(a) (i) Which of the following increase with the temperature of a star?

Put a (ring) around the **two** correct answers.

age **distance** **luminosity** **maximum wavelength** **peak frequency of light**

[2]

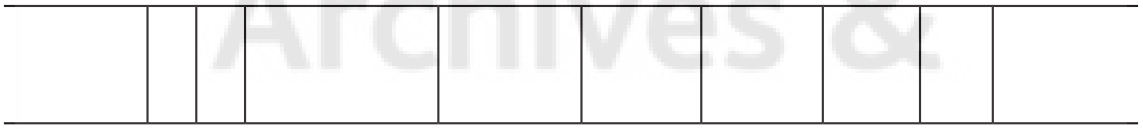
(ii) The surface temperature of a star is 6700 °C.

What is this temperature in kelvin?

temperature = ... K **[1]**

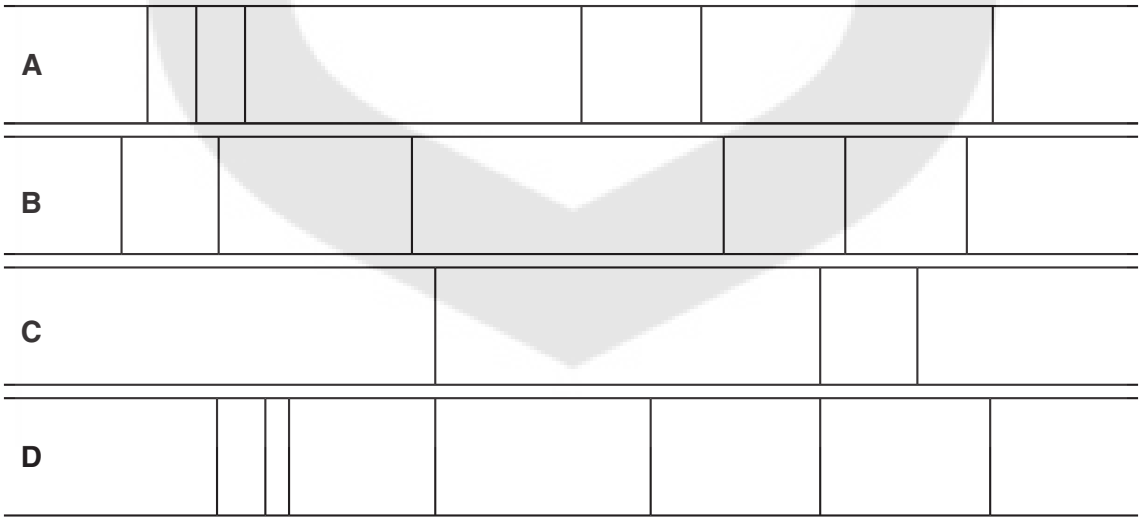
(b) Astronomers often look at the spectrum of a star's light.

(i) The diagram shows the spectrum from a star.



The spectrum can be used to work out which chemical elements are in the star.

Use the line spectra for the elements shown below to work out which elements are in the star.



Which **two** elements, from **A**, **B**, **C** and **D**, are in the star?

answer ..... and ..... **[2]**

(ii) Complete the sentences about lines in a spectrum.

Choose words from the list.

electrons **light** **line** **neutrons** **parallax**

The lines in a spectrum from a star are caused by the movement of ……..…… in atoms.

This type of spectrum is called a ……..…… spectrum.

[2]

[Total: 7]

6 At the beginning of the 20th century scientists could not explain how stars produced so much energy.

(a) It was not until the structure of atoms was understood that an explanation for stars producing so much energy was found.

One of the key experiments was the Rutherford-Geiger-Marsden alpha particle scattering experiment.

What did the results of the Rutherford-Geiger-Marsden alpha particle scattering experiment tell us about atoms?

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

Atoms have a small positive centre. ☐

Atoms are the smallest possible particles. ☐

Atoms are surrounded by large positive charges. ☐

Atoms only contain large negative charge. ☐

[1]

(b) **(i)** What is the process by which stars produce such large amounts of energy?

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

reflection ☐

nuclear fusion ☐

combustion ☐

nuclear fission ☐

[1]

(ii) Describe briefly how the energy produced in the **centre** of the Sun is transferred to the Earth.

Your answer should include

- the two main methods of energy transfer inside the Sun
- the method of energy transfer to the Earth.

One mark is for a clear and well ordered answer.

.....

.....

.....

.....

..... **[3+1]**

[Total: 6]

Turn over for question 7

7 **(a)** The nearest star to the Earth, other than the Sun, is about 1 parsec (pc) away.

A galaxy is about 1 megaparsec (Mpc) away.

How many times further away is the galaxy than the star?

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

(b) Measuring the distance to stars and galaxies is difficult.

Many different methods are used.

Here are four methods.

A brightness and colour of stars
B Cepheid variable stars
C parallax
D speed of recession of galaxies

(i) Which method, **A**, **B**, **C** or **D**, showed that some nebulae were outside the Milky Way galaxy?

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

(ii) An astronomer used method **D** on a galaxy.

She found the galaxy is at a distance of 200 Mpc.

The Hubble constant is 70 km/s per Mpc.

Calculate the speed of recession of the galaxy.

Show your working.

speed = ... km/s **[2]**

[Total: 4]

END OF QUESTION PAPER

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE PHYSICS A

A333/01/INS

Unit 3: Ideas in Context plus P7 (Foundation Tier)

INSERT

Wednesday 9 June 2010
Afternoon

Duration: 60 minutes

OCE/16034

INSTRUCTIONS TO CANDIDATES

- This insert contains the article required to answer question 1.

INFORMATION FOR CANDIDATES

- This document consists of **4** pages. Any blank pages are indicated.

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Climate ‘fix’ could deplete ozone

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TWENTY FIRST CENTURY SCIENCE PHYSICS A

A333/02

Unit 3: Ideas in Context plus P7 (Higher Tier)

OCE/16033

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

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Wednesday 9 June 2010
Afternoon

Duration: 60 minutes

A333302

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. 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 **55**.
- A list of physics equations is printed on page 2.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- 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

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

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

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

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

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

The Wave Model of Radiation

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

Further Physics, Observing the Universe

$$\text{lens power} = \frac{1}{\text{focal length}}$$

$$\text{magnification} = \frac{\text{focal length of objective lens}}{\text{focal length of eyepiece lens}}$$

$$\text{speed of recession} = \text{Hubble constant} \times \text{distance}$$

Answer **all** the questions.

This question is based on the article 'Climate 'fix' could deplete ozone'.

1 **(a)** In the article, Dr Tilmes says '… to make decisions you need to know what is good about it and what is bad about it.'

(i) In what situation might it be a good idea to use the sulfate particles to cool the planet?

Your answer should include

- a risk
- a benefit
- the situation when the benefit might outweigh the risk.

.....

.....

.....

.....

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

(ii) If the sulfate particles are used in the upper atmosphere, this can increase the risk to people.

Suggest one thing that individuals could do to reduce the risk to themselves.

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

(b) The article suggests that in some circumstances there is a correlation between sulfate particles in the upper atmosphere and reducing global temperatures.

(i) The evidence provided in the article to support the correlation is not convincing.

Explain why.

Your answer should include

- what the evidence is
- why it is not convincing.

One mark is for a clear and well ordered answer.

.....

.....

.....

..... **[2+1]**

(ii) Use your knowledge of global warming to suggest a scientific explanation of the correlation between sulfate particles and reducing global temperatures.

.....

.....

.....

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

(iii) Explain why an answer to part **(ii)** makes the argument stronger for the link between sulfate particles in the upper atmosphere and reducing global temperatures.

.....

.....

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

(c) Many people get confused between 'the greenhouse effect' and 'holes in the ozone layer'.

Explain the difference between the two.

Your answer should include

- the main gases in the atmosphere involved
- the role of the gases
- the main results of each.

.....

.....

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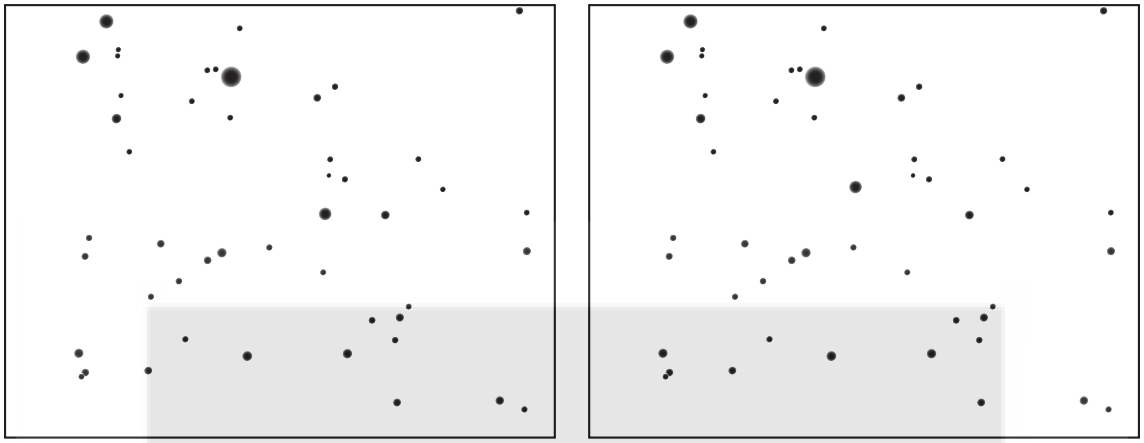
.....

..... **[4]**

[Total: 15]

2 Angie is taking photos of the night sky.

Here are two of her pictures.



23rd July 2009 28th July 2009

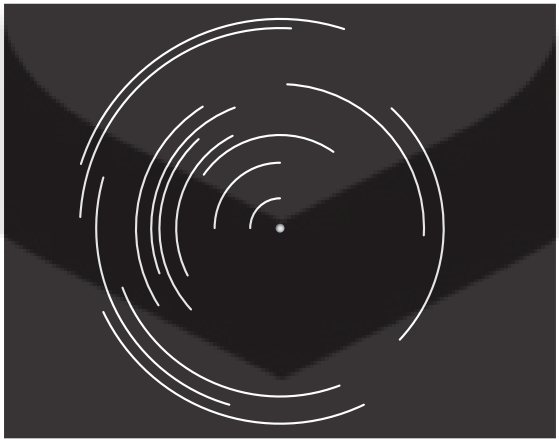
(a) **(i)** Clearly label the planet on one of the pictures. **[1]**

(ii) Suggest why the Ancient Greeks called the planets 'wandering stars'.

.....

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

(b) Angie points her telescope and camera at the pole star and takes a photograph over a few hours.



(i) Explain why most of the stars appear as lines in the photograph.

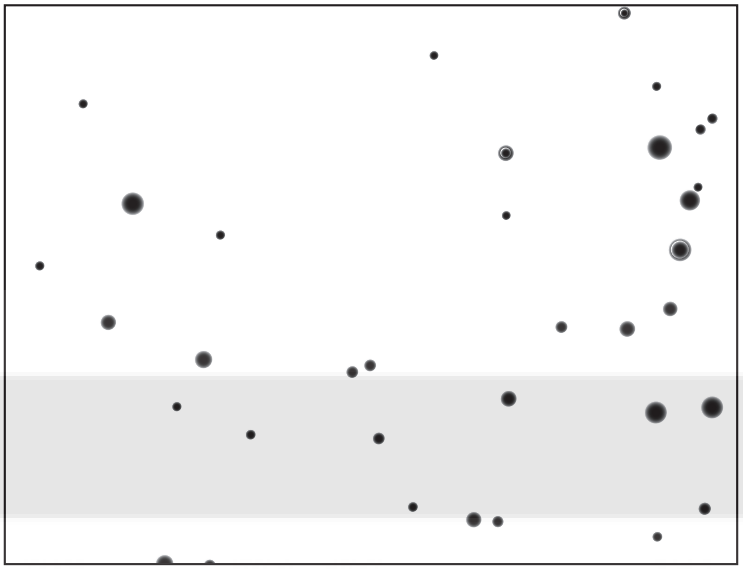
.....

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

(ii) For how long was the camera taking the photograph, to the nearest hour?

answer ..... hours **[1]**

(c) Angie takes a picture of the sky six months later at the same time of night.



23rd January 2010

Why are different stars seen in the picture?

You may use a diagram to help in your explanation.

.....

.....

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

(d) A solar day is the time it takes for the Sun to move once across the sky.

A sidereal day is the time it takes for the Earth to rotate once on its axis.

Explain why the solar day is longer than the sidereal day.

.....

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

(e) Angie wants to look at the Andromeda galaxy.

She looks up its position using the internet:

altitude: +32 deg 20 min
azimuth: +11 deg 12 min

Explain how these numbers help Angie find the Andromeda galaxy in the sky.

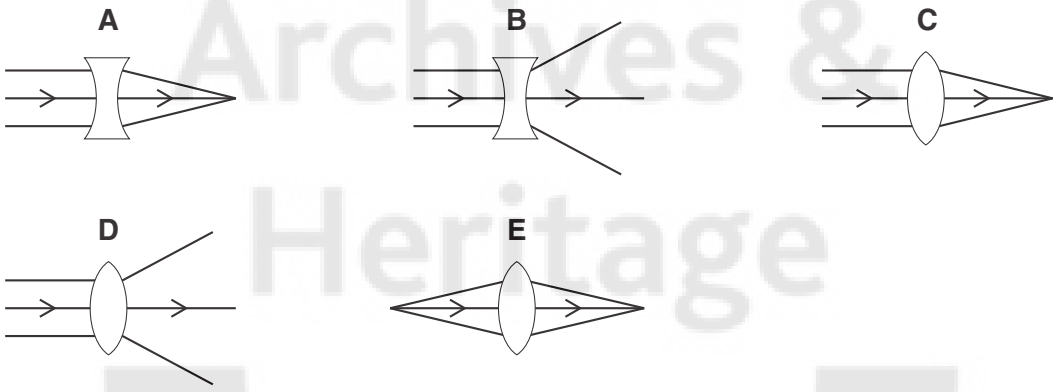
.....

.....

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

(f) **(i)** Angie focuses her telescope on a very distant star.

The light from the star passes through the objective lens of the telescope.



Which diagram, **A**, **B**, **C**, **D** or **E**, correctly shows the light passing through the lens?

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

(ii) Angie's telescope is at the bottom of her garden.

She wants to control it and view the images on her computer in her bedroom.

What advantages will Angie get from using a computer to remotely control her telescope?

.....

.....

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

[Total: 13]

3 Fred is a lens maker.

(a) He makes four convex lenses from the same type of glass.

lens	diameter in cm	thickness at middle in cm
A	5	0.25
B	5	0.5
C	5	0.75
D	5	0.3

Which lens will be the most powerful?

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

(b) A second set of lenses have the following properties.

lens	diameter in cm	power in D
W	4	20
X	5	1
Y	10	0.67
Z	7	1.25

(i) What is the focal length of lens **W**?

focal length = ... **[2]**

(ii) Fred decides to use lens **Z** as an objective lens in a simple telescope.

Which lens should he choose as his eyepiece lens?

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

(iii) Which of the lenses, **W**, **X**, **Y** or **Z**, would be the best objective lens in a telescope for observing faint objects?

Explain your answer.

lens .....

explanation .....

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

(c) Fred also makes telescopes which do not use convex lenses as their objectives.

What does Fred use in place of the lens?

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

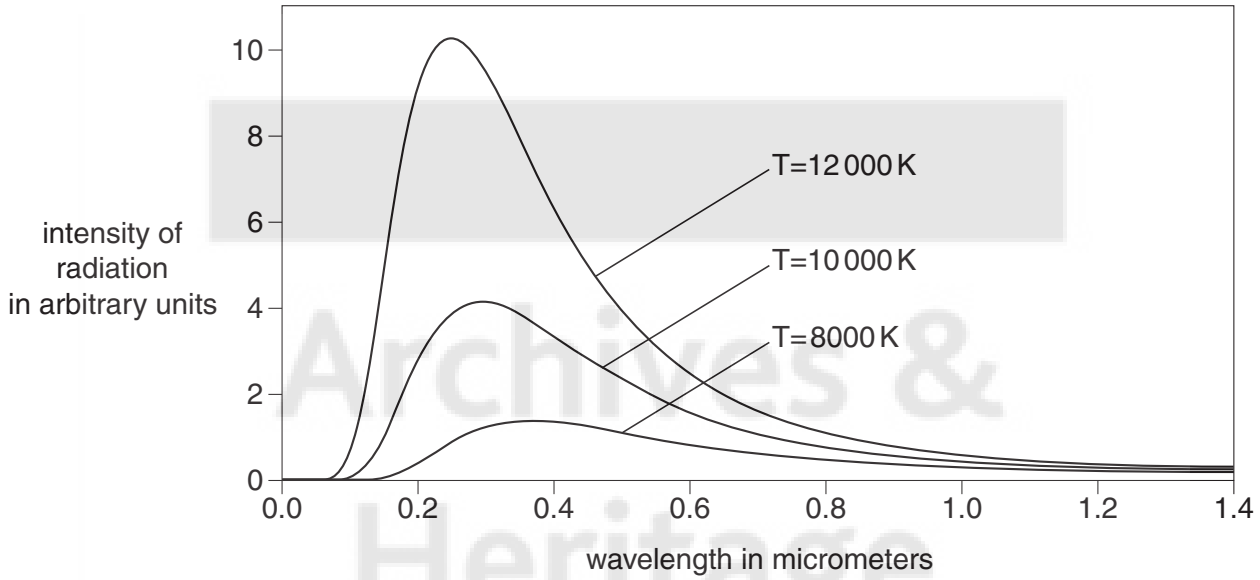
[Total: 8]

4 All the information we have about stars comes from the electromagnetic radiation we receive from the stars.

(a) (i) What is the relationship between the temperature and luminosity of a star?

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

(ii) The graph shows how the intensity of radiation varies with wavelength for three stars of different temperature.



How does the temperature of a star affect the wavelength of radiation emitted by the star?

.....

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

(iii) The surface temperature of a star is 6700 °C.

What is this temperature in kelvin?

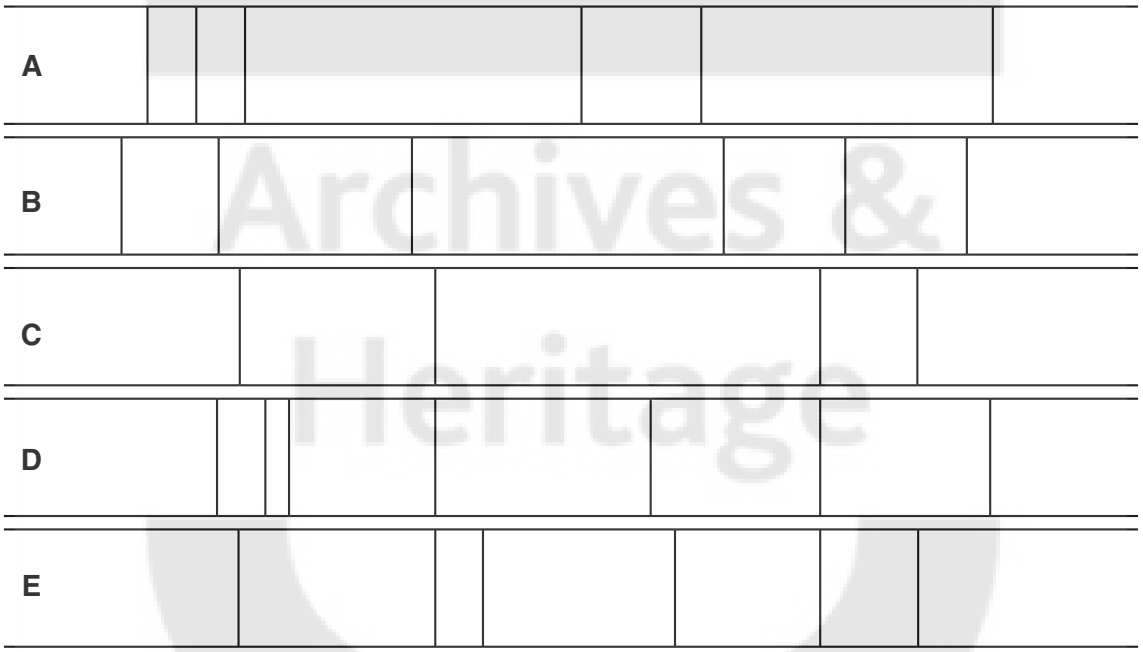
temperature = ... K **[1]**

(b) Much of the information about stars is found in the spectrum of the star.

The diagram shows the spectrum from a star.

The spectrum can be used to work out which chemical elements are in the star.

Use the line spectra for the elements shown below to work out which elements are in the star.



Which elements, from **A**, **B**, **C**, **D** and **E**, are in the star?

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

[Total: 5]

5 At the beginning of the 20th century scientists could not explain how stars produced so much energy.

(a) Scientists understood why a star's temperature increased when it first formed from a gas cloud.

Explain why the temperature of a star increases as it forms from a gas cloud.

.....

.....

.....

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

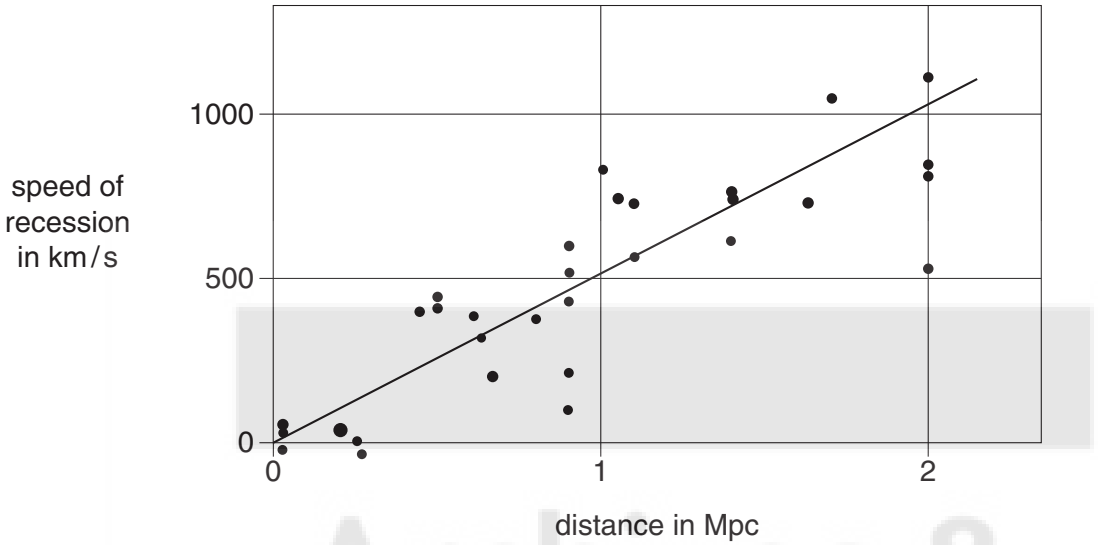
(b) What is the process by which stars produce so much energy?

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

[Total: 4]

6 Edwin Hubble was an astronomer working in the early 20th century.

(a) This graph shows the results of Edwin Hubble's research into galaxies, published in 1929.



(i) The Hubble constant is the gradient of the graph.

Use the graph to find the value of the Hubble constant.

Hubble constant = ... km/s per Mpc **[2]**

(ii) Hubble's data was very inaccurate.

A recent estimate of the Hubble constant is 71 km/s per Mpc.

Use this value to calculate the distance to a galaxy with a speed of recession of 750 km/s.

Show your working.

distance = ... **[3]**

(b) Hubble measured the distance to galaxies using Cepheid variable stars.

(i) Explain how Cepheid variable stars can be used to measure distance.

.....

.....

.....

.....

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

(ii) Before the Cepheid variable method could be used, the distance to the nearest Cepheid variables had to be found.

To do this, **two** other methods for measuring the distance to the nearest Cepheid variables had to be used.

How would the distance to the nearest Cepheid variables be found?

.....

.....

.....

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

[Total: 10]

END OF QUESTION PAPER

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TWENTY FIRST CENTURY SCIENCE PHYSICS A

A333/02/INS

Unit 3: Ideas in Context plus P7 (Higher Tier)

INSERT

Wednesday 9 June 2010
Afternoon

Duration: 60 minutes

OCE/16035

INSTRUCTIONS TO CANDIDATES

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