OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A331/02

PHYSICS A

Unit 1 Modules P1 P2 P3
(Higher Tier)

CUP/T71688

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)

Monday 19 January 2009
Morning

Duration: 40 minutes

A331 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, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

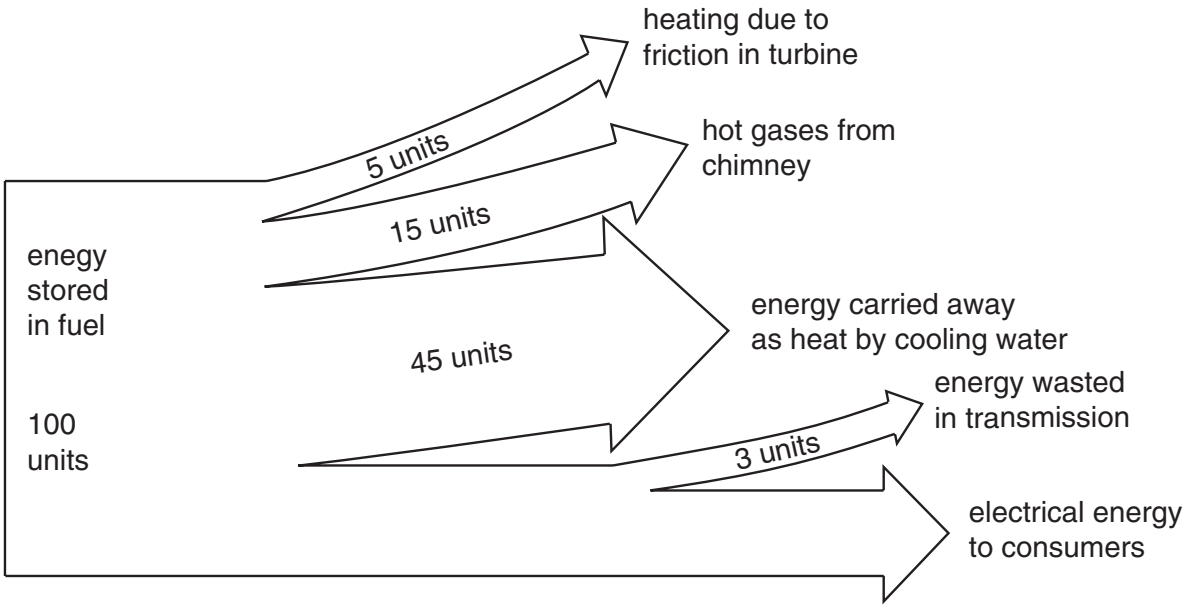
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**8**	
2	**4**	
3	**6**	
4	**4**	
5	**5**	
6	**4**	
7	**3**	
8	**4**	
9	**4**	
TOTAL	**42**	

Answer **all** the questions.

1 Generating and distributing electricity is not 100% efficient.

Look at this diagram for electricity generation by a fossil fuel power station.



(a) (i) How many units of electrical energy go to consumers?

Put a (ring) around the correct answer in the list below.

3 **32** **35** **68** **100**

[1]

(ii) 65 units of energy are wasted in the power station.

What is the **efficiency** of the power station?

Put a (ring) around the correct answer in the list below.

3% **35%** **45%** **54%** **65%**

[1]

(b) Which element present in the fossil fuel will produce a greenhouse gas when it is burnt?

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

Sulfur ☐

Oxygen ☐

Carbon ☐

Uranium ☐

[1]

(c) Some scientists suggest that nuclear fuel would be a better choice as an energy resource for electricity generation in the future.

Nuclear fuel releases energy through the process of nuclear fission.
Complete the sentences below to describe the process of fission in a nuclear power station.

Choose the best words from the word box below.

You may use each word once, more than once or not at all.

chain	**chemical**	**electrical**	**electron**	**five**
neutron	**proton**	**reversible**	**three**	**two**

A nucleus consists of neutrons and ..... s.

A slow moving ..... splits an unstable nucleus of Uranium into

..... smaller parts roughly equal in size.

More neutrons are also released which can go on to cause a ..... reaction.

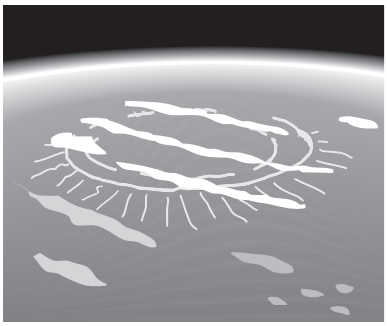
The amount of energy released in nuclear fission is much greater than in a

..... reaction.

[5]

[Total: 8]

2 This sketch is an artist's impression of a crater in Mexico.



Here is a list of observations;

- There was a mass extinction 65 million years ago, which killed off the dinosaurs.
- There is a very large crater in Mexico that is 65 million years old.
- Craters can be made by asteroids hitting the Earth.
- When an asteroid hits, a metal called iridium is often spread over a long distance.
- A layer of iridium, dated at 65 million years old was found in rocks in Italy.
- Italy is thousands of miles away from the crater in Mexico.

(a) Some scientists think the mass extinction of the dinosaurs was caused by a large asteroid hitting the Earth.

Which is the **best** reason to **accept** this explanation for the extinction of the dinosaurs?

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

There have been films made that use this explanation.	☐
It must have been something big to spread iridium across thousands of miles.	☐
This explanation accounts for these observations.	☐
Iridium is known to be extremely poisonous in high doses.	☐

[1]

(b) Some other scientists disagree with the explanation given above.

Which is the **best** reason to **reject** this explanation for the extinction of the dinosaurs?

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

These scientists do not believe that dinosaurs ever existed.	☐
These scientists do not understand the explanation fully.	☐
There are other observations which do not fit with this explanation.	☐
The two groups of scientists do not get on with each other.	☐

[1]

(c) Here are some statements related to the information above.

Some of them provide data.

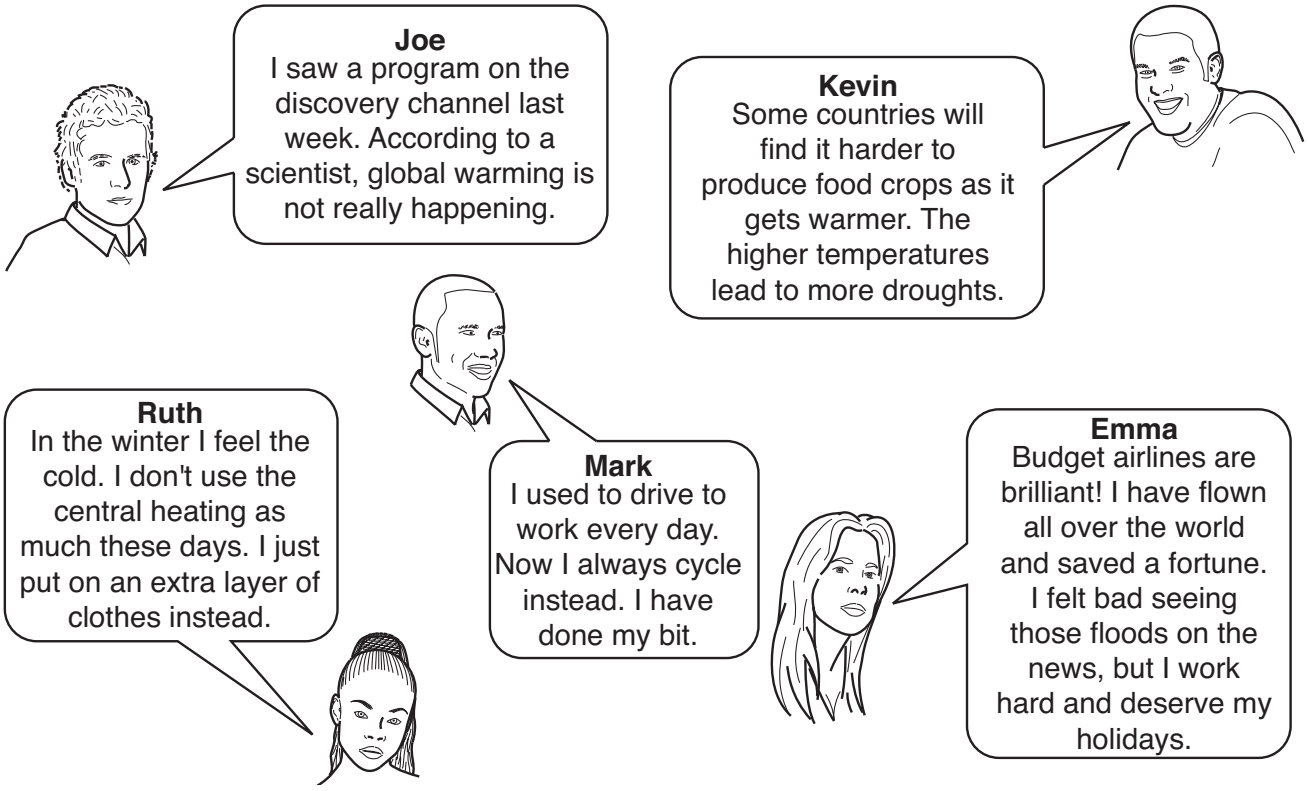
Put ticks (✓) in the boxes next to the **two** data statements.

Iridium is a metallic element often found near asteroid impacts.	☐
The iridium layer in Italy was caused by an asteroid impact in Mexico.	☐
There is a 65 million year old layer of iridium in Italy.	☐
The dinosaurs were probably killed by an asteroid hitting the Earth.	☐

[2]

[Total: 4]

3 A group of friends are discussing their views on global warming.



(a) Which **two** people have taken actions that will reduce the amount of carbon dioxide in the atmosphere?

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

(b) Which **one** person mentions a **correlation** between a factor and an outcome?

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

(c) Which **two** people have identified possible consequences of global warming?

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

(d) How could you **describe** the decision that Emma has made?

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

She is unaware of any risk, so she goes ahead.	☐
She believes the benefit outweighs the risk.	☐
She is aware of a risk and decides not to go ahead.	☐
She believes the risk outweighs the benefit.	☐

[1]

[Total: 6]

4 Most scientific theories develop over time, taking new observations into account.

The table below shows some theories and observations made that relate to those theories.

Decide whether each observation **agrees** with, **disagrees** with or **proves** the related theory.

Put a tick (✓) in the correct column next to each theory to show your choice.

theory	observations	agrees	disagrees	proves
The Universe was created around 6000 years ago.	Radioactive dating shows that the oldest rocks on the Earth are around 3900 million years old.			
The continents of the Earth were once joined together as a giant 'supercontinent' (Pangaea). The continents have since moved apart.	The seafloor spreads by about 10 cm each year as new rock is produced under the seas.			
Mountain chains were formed by the surface of the Earth 'wrinkling' as it cooled down long ago. This has now stopped.	The height of mountains in the southern alps is increasing by around 7 mm per year.			
The Universe started in a hot 'big bang' billions of years ago.	Distant galaxies are moving away from the Earth.			

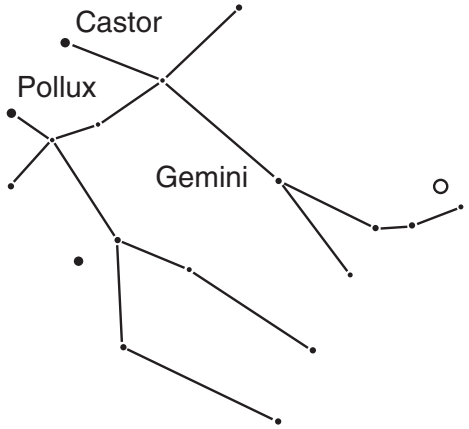
[4]

[Total: 4]

5 Pollux is a star located about 34 light years from Earth in a constellation known as Gemini (the twins).

Castor is a small group of stars about 50 light years from Earth and is part of the same constellation.

Pollux and Castor can both be seen from Earth with the naked eye.



(a) Some people believe that each dot in a constellation is a star.

In fact some of the dots are small groups of stars, galaxies or other luminous objects.

How is it possible for a galaxy to appear as a single dot of light in the night sky?

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

Stars expand as they get older, so they could be the same size as a galaxy.	☐
The apparent separation of stars is smaller when they are further away.	☐
Light from distant stars seems dimmer when they are far away.	☐
Some galaxies are very small.	☐

[1]

(b) The distance to Pollux is measured in light years.

(i) How fast does light travel?

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

300 000 000 km/s	☐
300 000 km/s	☐
300 km/s	☐
3 km/s	☐

[1]

(ii) Castor is 50 light years away.

Travelling at 10% of the speed of light, how many years would it take to reach Castor?

Put a (ring) around the correct answer.

0.2 **5** **30** **50** **500** **30 000**

[1]

(c) Some scientists are looking for evidence of life elsewhere in the Universe.

They are interested in finding planets outside of our solar system.

Which of the following statements explain why?

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

They currently have no evidence for life outside of our solar system.	☐
They can prove that Earth is the only planet with life by finding planets with no life on them.	☐
They can travel to the planet that they find to investigate it further.	☐
The more planets that are found, the more likely it is that life exists elsewhere.	☐

[2]

[Total: 5]

6 This question is about the disposal of nuclear waste.

(a) There are different categories of waste from a nuclear power station.

Which category of nuclear waste is usually dealt with by burial in a landfill site?

Put a (ring) around the correct category of waste.

intermediate level **hazardous** **high level**

low level **radioactive**

[1]

(b) Some categories of nuclear waste remain very radioactive for many years.

There is disagreement about what should be done to dispose of this waste in the long term.

Some people feel the precautionary principle should be applied to this problem.

Put a tick (✓) in the box next to the statement which best describes the precautionary principle.

what you don't know cannot hurt you ☐

everything in moderation ☐

better safe than sorry ☐

out of sight, out of mind ☐

[1]

(c) Some radioactive waste has a very long **half-life**.

One radioactive chemical found in nuclear waste has a half-life of 24 000 years.

(i) What **percentage** of this radioactive chemical remains after 24 000 years?

Put a (ring) around the correct answer.

0% **0.5%** **24%** **25%** **50%**

[1]

(ii) Calculate the **fraction** of the radioactive chemical that remains after 72 000 years.

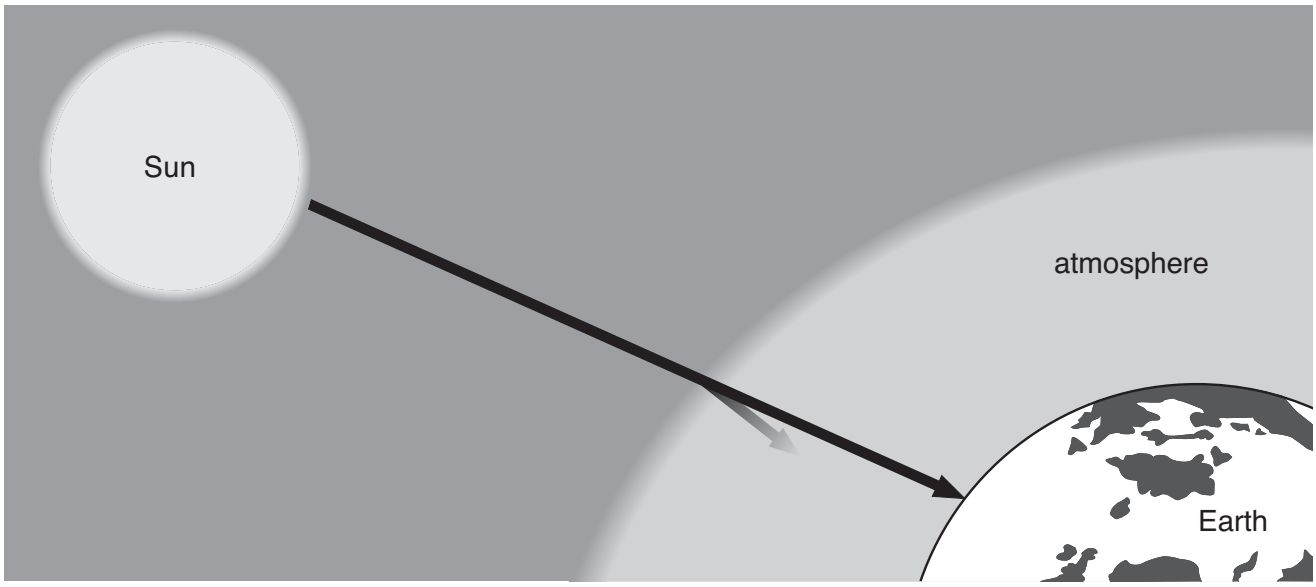
Put a (ring) around the correct answer.

none **1/8** **1/4** **1/3** **7/8** **3/2**

[1]

[Total: 4]

7 Here is a diagram to show what happens when radiation from the Sun arrives at the Earth.



Ionising radiation from the Sun can damage our health if it reaches the Earth's surface.

Choose one phrase from each column to make a **single sentence** describing how the atmosphere helps to protect us from **ionising radiation**.

Write the correct letter for each phrase in the box at the bottom of its column.

Type of radiation	What happens in the atmosphere	The change to the atmosphere
A Microwave radiation from the Sun …	**P** … is absorbed by nitrogen in the atmosphere …	**X** … causing a permanent change to the atmosphere.
B Ultraviolet radiation from the Sun …	**Q** … is absorbed by carbon dioxide in the atmosphere …	**Y** … causing a temporary chemical change to the atmosphere.
C Light radiation from the Sun …	**R** … is absorbed by ozone in the atmosphere …	**Z** … causing no change to the atmosphere.
D Infrared radiation from the Sun …		

answer	answer	answer

[3]

[Total: 2]

8 Nadina has installed a wireless network in her home.

The connection is made through a device called a wireless router.

The router emits microwaves to connect her two computers to the internet.

(a) What does the intensity of a beam of electromagnetic radiation arriving at an object depend upon?

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

The shape of the object receiving the radiation.	☐
The energy of each photon arriving.	☐
The size of the object receiving the radiation.	☐
The number of photons arriving at the object each second.	☐
The total number of photons arriving at the object.	☐

[2]

(b) Nadina's router is upstairs. She finds that her computer downstairs gets a weaker signal than the one upstairs.

Which statements when combined could explain this problem?

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

Some photons are absorbed as the beam travels through the walls and floors.	☐
Microwave photons cannot travel very far as they have relatively low energy.	☐
Microwave photons spread apart as they travel away from the router.	☐
Microwave photons lose energy as they travel away from the router.	☐

[2]

[Total: 4]

9 Look at the table of data for four different radioactive materials.

The table is incomplete.

name of radioactive material	number of protons	number of neutrons	number of electrons
uranium 235	92	143	92
radon 222	86	**X**	86
protactinium 231	91	140	91
uranium 238	**Y**		

(a) (i) What is the value of **X** in the table above?

X = ……..…

(ii) What is the value of **Y** in the table above?

Y = ……..…

[2]

(b) The element protactinium 231 emits **alpha** radiation when it decays into actinium.

An alpha particle is made of two protons and two neutrons.

(i) How many protons are in the actinium nucleus?

Put a (ring) around the correct answer.

87 **89** **91** **93** **223**

225 **227**

[1]

(ii) How many neutrons are in the actinium nucleus?

Put a (ring) around the correct answer.

132 **134** **136** **138** **223**

225 **227**

[1]

[Total: 4]

END OF QUESTION PAPER

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