OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE A213/02

SCIENCE A

Unit 3: Modules B3 C3 P3 (Higher Tier)

OCE/31669

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)

Friday 18 June 2010
Afternoon

Duration: 40 minutes

A213 02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

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 **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Using radioactive materials to kill cancer is called radiotherapy.

In one form of radiotherapy a small amount of radioactive material is put inside a patient's body, near the cancerous cells.

One material used for this type of radiotherapy emits beta radiation.

(a) (i) Beta radiation is more suitable for this type of radiotherapy than alpha radiation or gamma radiation.

Which of the following statements **explain** why?

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

Beta radiation carries a negative electrical charge.	☐
Alpha radiation carries a positive electrical charge.	☐
Beta radiation is less ionising than alpha radiation.	☐
Beta radiation is more penetrating than alpha radiation.	☐
Gamma radiation is part of the electromagnetic spectrum.	☐
Gamma radiation is not absorbed as easily as beta radiation.	☐

[2]

(ii) The treatment for one patient used 2 mg of radioactive material. The material has a long half-life.

The radioactive material was taken out of the patient's body after 10 days.

The patient had a 0.2 sievert dose of radiation from the treatment.

Which of the following changes to the treatment would give a dose of 0.4 sievert?

Put a tick (✓) in the **one** correct box.

amount of radioactive material	**time it is in the patient**	
2 mg	5 days	
2 mg	20 days	
4 mg	5 days	
4 mg	20 days	

[1]

(b) The surgeons at the hospital who put the radioactive material into the patient are also at risk.

Explain what is meant by the ALARA principle, and how the hospital needs to apply it to reduce the risk to the surgeons.

.....

.....

.....

.....

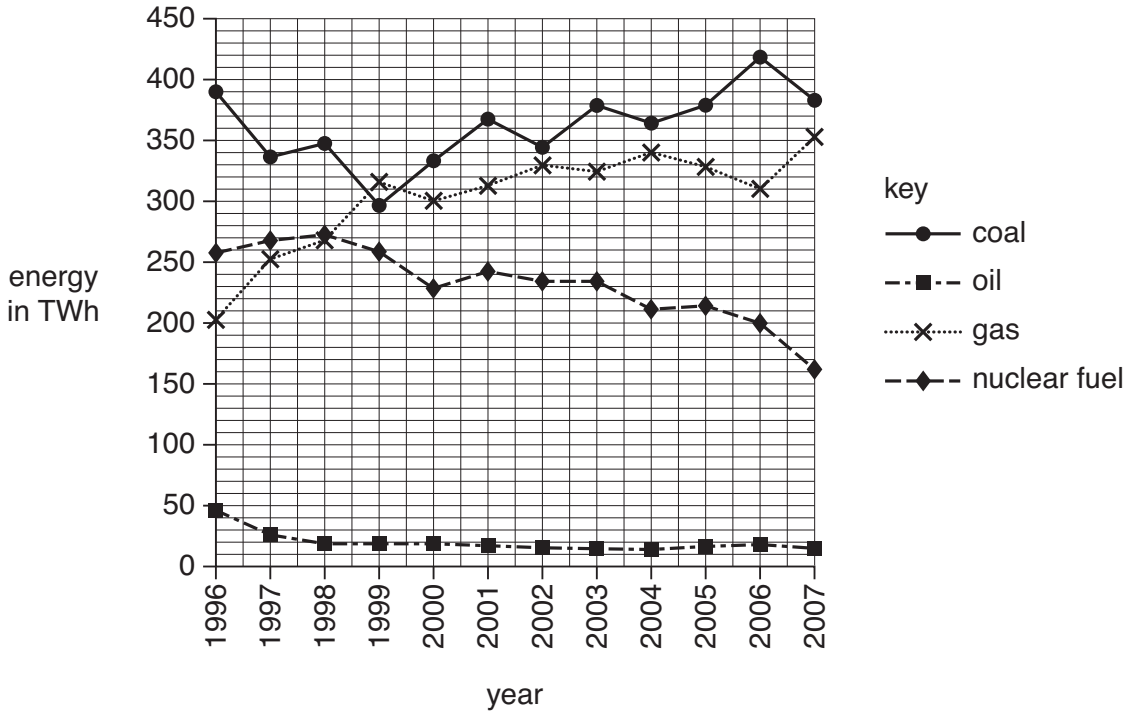
..... **[3]**

[Total: 6]

2 This question is about generating electricity.

(a) The graph shows the amount of electrical energy generated in Great Britain from 1996 to 2007. The amount of energy is measured in terawatt-hours (TWh).

The electricity was generated from four different sources: coal, oil, gas and nuclear fuel.



(i) Which one of the following decreased by the greatest amount from 1996 to 2007 – electrical energy generated from **coal**, **oil**, **gas** or **nuclear fuel**?

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

(ii) In which one year did gas generate more electrical energy than any other fuel?

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

(iii) Which fuels generated more than 250 TWh in any year since 2000?

Write the name of **each** correct fuel in this space.

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

(iv) Which fuels generated less than 200 TWh in any year on the graph?

Write the name of **each** correct fuel in this space.

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

(b) Read the article about Combined Heat and Power (CHP) stations.

Thermal electrical power stations are powered by fossil fuels or nuclear power. They have a low efficiency of around 35%. This can be improved if the 'waste' heat is used. One way to do this is to pump hot water from the power station around local housing for space-heating.

Used this way, the power station becomes a Combined Heat and Power (CHP) station and the energy wasted drops to about 25%.

Which of these statements about CHP stations are true?

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

They use renewable energy sources. ☐

They are more efficient than other thermal power stations. ☐

They produce less heat than other power stations. ☐

They are more useful in a town than in the countryside. ☐

They produce more electricity than other power stations. ☐

[1]

[Total: 5]

3 This question is about radioactive isotopes.

(a) For an atom of an element,

N = number of neutrons

Z = number of protons

A = **N** + **Z** = the total number of particles in the nucleus.

Which of these numbers stay the **same** for atoms of different isotopes of an element?

Put a tick (✓) in the **one** correct box.

A only	☐
N only	☐
Z only	☐
A, **N** and **Z**	☐

[1]

(b) A radioactive isotope of radium decays with a half-life of 15 days.

You start with 16 grams of this isotope. How long will it take until there is only 1 gram of the isotope left?

Show your working clearly.

answer = ... days **[2]**

[Total: 3]

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Question 4 starts on page 8.

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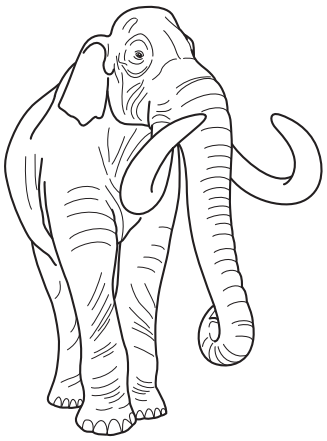
4 Read the newspaper article.

Mammoth skull found



A fossil of a mammoth skull has been found in France.

The skull is the most complete steppe mammoth skull ever found.

Steppe mammoths are thought to be a stage in evolution between the southern mammoth and the woolly mammoth.

(a) Fossils are one source of evidence for evolution.

Another source of information about evolutionary relationships is the chemical that chromosomes are made from.

Name this chemical.

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

(b) Jade is explaining to her mother how a new species can evolve.

Not all Jade's statements agree with accepted current scientific explanations.

This is what she says.

Jade

Mammoths changed over time – this is an example of evolution. Individual southern mammoths were different from each other. Differences between individuals could be due to the genes inherited from their parents or due to the environment. Both of these types of variation can be passed on to the next generation.

As well as this, mutations occur by chance. Mutations are changes to proteins. If the mutation is in a sex cell it can be inherited.

Over a long time the typical characteristics of the southern mammoths changed so much that a new species had been produced.

Put a tick (✓) in the correct box after each statement to show if it **agrees** or **disagrees** with current scientific explanations.

Jade's statements	agrees	disagrees
Mammoths changed over time – this is an example of evolution.	☐	☐
Differences between individuals could be due to the genes inherited from their parents or due to the environment.	☐	☐
Both of these types of variation can be passed on to the next generation.	☐	☐
Mutations occur by chance.	☐	☐
Mutations are changes to proteins.	☐	☐
If the mutation is in a sex cell it can be inherited.	☐	☐

[3]

[Total: 4]

5 Two communication systems have evolved in multicellular animals.

(a) Name the two communication systems present in multicellular animals.

..... system and ..... system **[1]**

(b) Complete the sentences to describe how the communication systems work.

Use **one** word in each case.

Stimuli or changes are detected by …… cells.

The change caused by the stimulus is called a …… .

The changes are produced by …… cells.

[3]

(c) Maintaining a constant internal environment is one function of the body's communication systems.

Write down the scientific term for maintaining a constant internal environment.

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

[Total: 5]

6 Natural selection was first described by Darwin and Wallace.

When Darwin and Wallace published their ideas in 1858, many people disagreed with the idea of natural selection.

Suggest **two** reasons why many people at this time rejected natural selection.

.....

.....

.....

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

[Total: 2]

7 Read the newspaper article on Neanderthal man.

Latest research on Neanderthal man

early Modern man

Neanderthal man

Neanderthal man probably became extinct about 24 000 years ago, during the last Ice Age.

Scientists have recently excavated a cave near Gibraltar. They found evidence of fires and flint stone tools which had been used by Neanderthal man. This was long after it had been thought that Neanderthals were extinct. By this time, early Modern man had arrived in Gibraltar. These observations show that early Modern man and Neanderthal man lived at the same time and in the same places.

(a) Some scientists originally thought that Neanderthal man was extinct before early Modern man appeared.

The new evidence suggests that this theory is not correct.

Suggest **two** reasons why scientists may be reluctant to give up an explanation when new data appears to conflict with it.

1.....

.....

2.....

.....

[1]

(b) Suggest **two** possible reasons why Neanderthal man became extinct, apart from competition.

.....

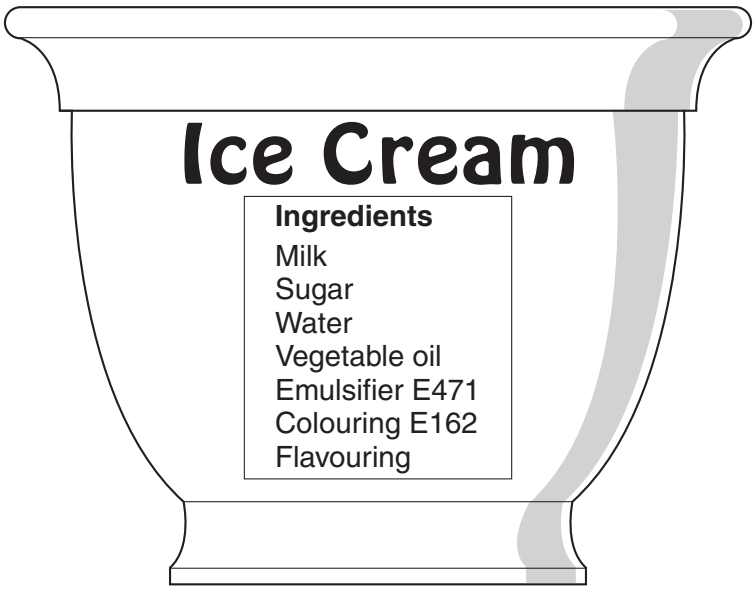
.....

.....

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

[Total: 3]

8 The label on a tub of ice cream shows the ingredients in the ice cream.



(a) (i) Emulsifiers are added to food.

They help some ingredients to mix together.

Which two ingredients in ice cream need an emulsifier so they can mix together?

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

sugar ☐

water ☐

vegetable oil ☐

colouring ☐

flavouring ☐

[2]

(ii) Most additives are given E numbers.

Here are four statements about additives with E numbers.

They are not all true.

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

	true	**false**
They all supply energy to the body.	☐	☐
They have passed a safety test.	☐	☐
They are approved for use in the UK.	☐	☐
They are never harmful.	☐	☐

[2]

(b) (i) Ice cream contains carbohydrates and proteins.

Complete each sentence by choosing the best word from this list.

A word may be used once, more than once or not at all.

fats

hydrocarbons

minerals

nitrogen

oxygen

polymers

sugars

sulfur

Starches and proteins are natural ……..…… .

Examples of carbohydrates are ……..…… .

Carbohydrates consist of carbon, hydrogen and ……..…… .

[3]

(ii) Complete the sentence about digestion.

Put a (ring) around the correct option in each box.

Some carbohydrates break down into | **amino acid** / **fatty acid** / **glucose** | molecules,

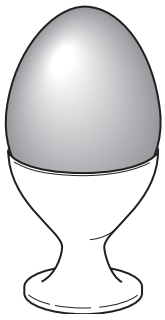
which are | **large insoluble molecules** / **small insoluble molecules** / **small soluble molecules** | that are | **absorbed into the blood.** / **mixed into the blood.** / **precipitated into the blood.**

[1]

[Total: 8]

9 Read this report.

An egg a day – the risk

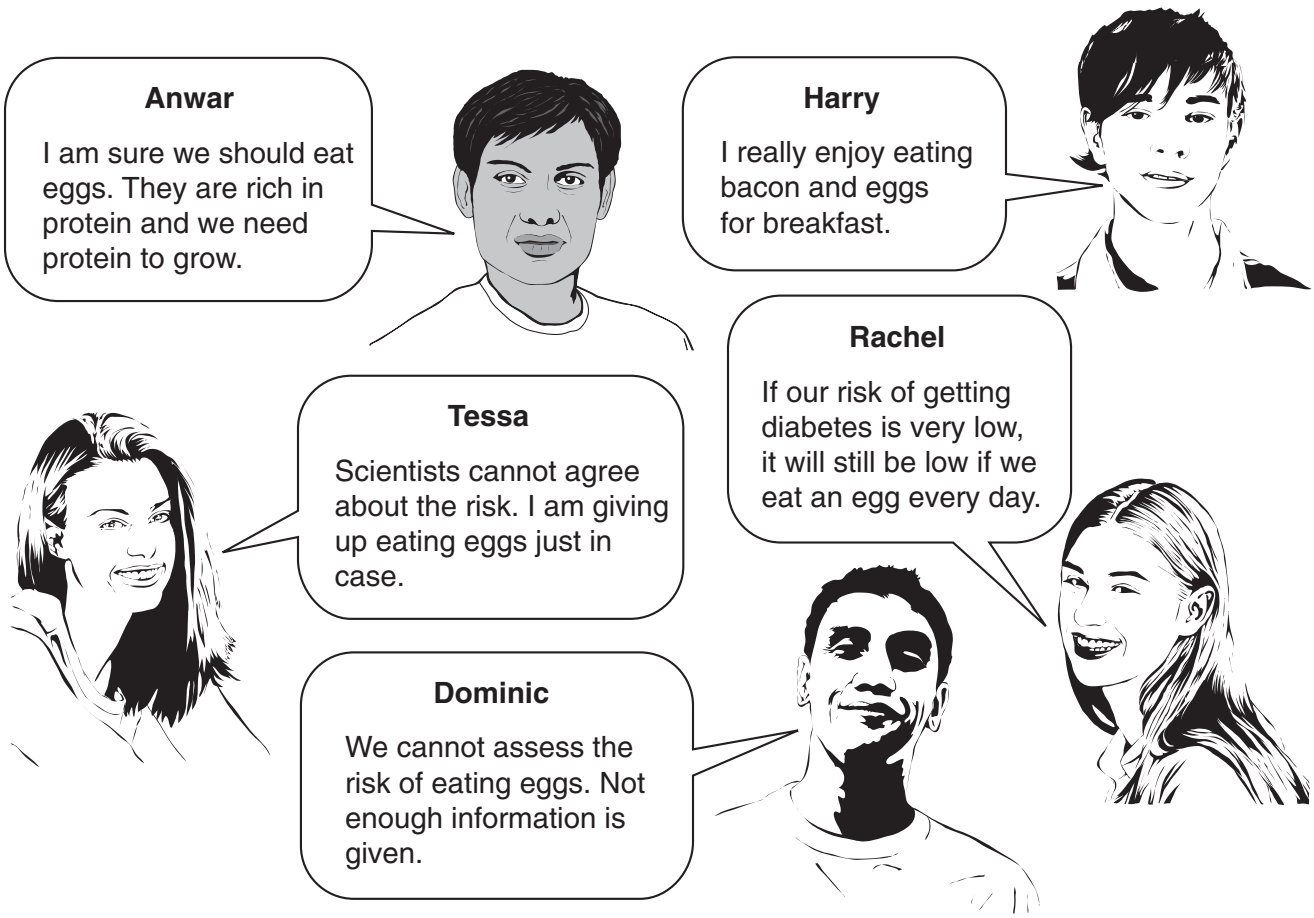


Recent research suggests that an egg a day raises the risk of type 2 diabetes. Scientists reached this conclusion after tracking 57 000 men and women over a period of 20 years.

They found that eating an egg every day increased the overall risk of type 2 diabetes by about 60 per cent. Eating just one egg a week carried no increased risk.

Other scientists disagree with this research. They say that other lifestyle factors were not considered in the study, and that there is no possible mechanism to explain the link.

Some students are talking about the report.



(a) Which **one** person is applying the **precautionary** principle?

Put a tick (✓) in the **one** correct box.

Harry	☐
Anwar	☐
Rachel	☐
Tessa	☐
Dominic	☐

[1]

(b) Using the information given above, explain why some people may still choose to eat lots of eggs.

Use ideas about **risk** and **benefit** in your answer.

.....

.....

.....

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

(c) Dominic says that we cannot assess the risk of eating eggs.

What information does he need in order to assess the risk?

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

[Total: 6]

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