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| Candidate Forename | | Candidate Surname | |
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| Centre Number | | | | | | Candidate Number | | | | |
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A213/02

**TWENTY FIRST CENTURY SCIENCE
SCIENCE A**

**UNIT 3: Modules B3 C3 P3
Higher Tier**

**FRIDAY 18 JUNE 2010: Afternoon
DURATION: 40 minutes**

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

**Pencil
Ruler (cm/mm)**

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [] at the end of each question or part question.**
- **The total number of marks for this paper is 42.**

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.

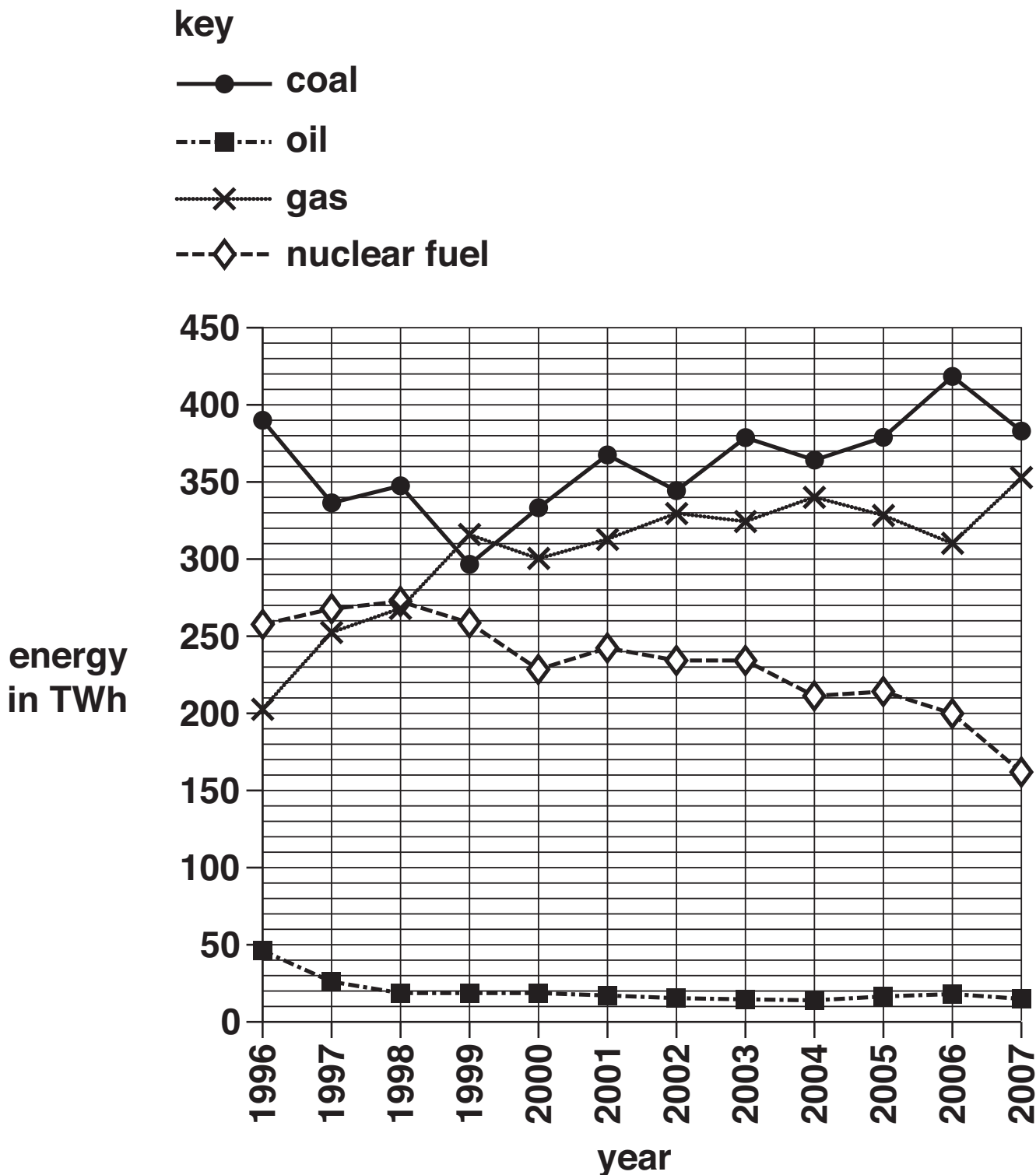
[3]

[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) Electrical energy generated from which source, COAL, OIL, GAS or NUCLEAR FUEL, decreased by the greatest amount from 1996 to 2007?

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 250TWh in any year since 2000?

Write the name of EACH correct fuel in this space.

_____ [1]

- (iv) Which fuels generated less than 200TWh 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.

If you start with 16 grams of this isotope, how long would it take until there is only 1 gram of the isotope left?

Show your working clearly.

answer = _____ days [2]

[Total: 3]

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.

| <u>JADE'S STATEMENTS</u> | <u>AGREES</u> | <u>DISAGREES</u> |
|-------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Mammoths changed over time – this is an example of evolution. | <input type="checkbox"/> | <input type="checkbox"/> |
| Differences between individuals could be due to the genes inherited from their parents or due to the environment. | <input type="checkbox"/> | <input type="checkbox"/> |
| Both of these types of variation can be passed on to the next generation. | <input type="checkbox"/> | <input type="checkbox"/> |
| Mutations occur by chance. | <input type="checkbox"/> | <input type="checkbox"/> |
| Mutations are changes to proteins. | <input type="checkbox"/> | <input type="checkbox"/> |
| If the mutation is in a sex cell it can be inherited. | <input type="checkbox"/> | <input type="checkbox"/> |

[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) One function of the body's communication systems is to maintain a constant internal environment.

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

_____ [1]

[Total: 5]

6 Natural selection was first described by Darwin and Wallace.

In 1858, when Darwin and Wallace published their ideas, 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

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, 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) Apart from competition, suggest TWO OTHER possible reasons why Neanderthal man became extinct.

[2]

[Total: 3]

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

Ice Cream

INGREDIENTS

Milk

Sugar

Water

Vegetable oil

Emulsifier E471

Colouring E162

Flavouring

- (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.

| | <u>TRUE</u> | <u>FALSE</u> |
|---------------------------------------------|--------------------------|--------------------------|
| They all supply energy to the body. | <input type="checkbox"/> | <input type="checkbox"/> |
| They have passed a safety test. | <input type="checkbox"/> | <input type="checkbox"/> |
| They are approved for use in the UK. | <input type="checkbox"/> | <input type="checkbox"/> |
| They are never harmful. | <input type="checkbox"/> | <input type="checkbox"/> |

[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 increases 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.

ANWAR

I am sure we should eat eggs. They are rich in protein and we need protein to grow.

HARRY

I really enjoy eating bacon and eggs for breakfast.

RACHEL

If our risk of getting diabetes is very low, it will still be low if we eat an egg every day.

DOMINIC

We cannot assess the risk of eating eggs. Not enough information is given.

TESSA

Scientists cannot agree about the risk. I am giving up eating eggs just in case.

(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?

[3]

[Total: 6]

END OF QUESTION PAPER

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