UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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TWENTY FIRST CENTURY SCIENCE **0608/05**

Paper 5 **May/June 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
Total	

This document consists of **13** printed pages and **3** blank pages.

Nuclear power – the way forward?

Throughout the world, most electricity is generated from fossil fuels: oil, gas, and coal. There are problems with using fossil fuels:

- burning fossil fuels generates greenhouse gases
- oil and gas supplies are running out
- much of the remaining oil and gas reserves are in countries that are politically unstable.

Nuclear power has been available since the 1950s. Many countries use it to provide a reliable source of electricity. No greenhouse gas is produced by the power station once it has been built, and nuclear fuel provides a lot of energy per kilogram of fuel.

Uranium is not a renewable fuel, even though it should last longer than oil and gas. Opponents of nuclear power say that we should make more use of renewable sources of energy.

1 This question is based on the article 'Nuclear power – the way forward?'

(a) **(i)** Name **one** fossil fuel burnt in power stations.

..... [1]

(ii) Write down the name of the greenhouse gas produced when fossil fuels are burnt.

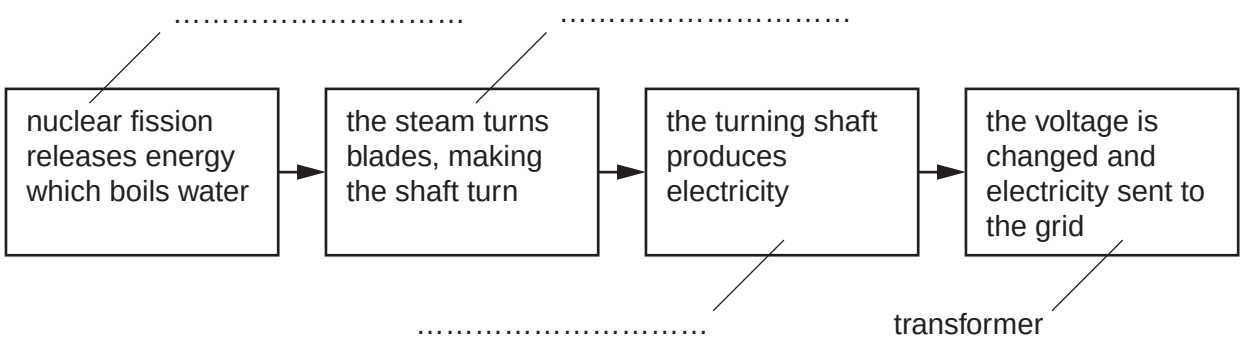
..... [1]

(b) The following block diagram shows how electricity is generated in a nuclear power station.

Complete the labelling of the blocks.

Choose words from this list:

generator **motor** **reactor** **turbine** **uranium**



[2]

(c) The article states 'no greenhouse gas is produced by the power station once it ha... built'.

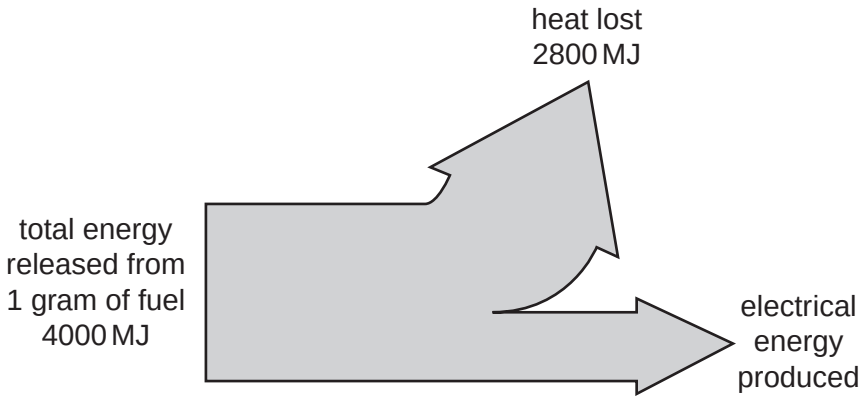
Explain why it is important to include details about **building** the nuclear power station in any assessment of damage to the environment.

.....

.....

.....[2]

(d) Nuclear fuel is a very concentrated energy source. The following energy flow diagram shows the energy released in MJ (millions of joules) from 1 gram of nuclear fuel in a nuclear power station.



Use the diagram to calculate the efficiency of this power station.

efficiency = ...% [3]

(e) Not all people are in favour of nuclear power stations.

Give **one** reason for, and **one** reason against, using nuclear power to generate electricity.

reason for: .....

.....

reason against: .....

.....[2]

(f) Many governments are looking for renewable forms of energy.

Unfortunately, many of these are not reliable.

(i) Choose **one** example of a renewable energy source.

..... [1]

(ii) Use your example to explain what is meant by **reliable**.

.....

.....

..... [1]

(g) In a nuclear reactor, energy is released by nuclear fission.

Explain what happens during nuclear fission.

Make sure that you write about **neutrons** and the **nucleus** in your answer.

.....

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.....

.....

..... [3]

[Total: 16]

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Please turn over for Question 2.

Nuclear waste reprocessing

Nuclear power has been important in many countries for over 50 years. However, there is still no agreement on how to dispose of the waste it produces.

Used fuel rods are removed from the reactor and placed in a storage pool. They remain there until the level of activity has decreased enough for them to be safe to transport. The rods are then sent to a reprocessing plant where the different chemicals in them are separated.

Waste from the reprocessing plant is classified into low level, intermediate level and high level. These are treated very differently. High level waste must be kept safe until it is intermediate level. At this point it can be disposed of, but no agreed method has yet been found for doing this. Some of the chemicals in intermediate level waste have half-lives of many thousands of years.

Workers in the reprocessing plant are exposed to risk from both contamination and irradiation, and must be protected from both sources of danger. There are strict laws in place to ensure the safety of these workers.

2 This question is based on the article 'Nuclear waste reprocessing'.

(a) One type of nuclear waste is low level waste. People who work with radioactive chemicals use protective clothing. The protective clothing becomes contaminated, and is an example of low level waste.

(i) Suggest **one** method of disposal that would be suitable for low level waste.

.....

..... [1]

(ii) Explain why this disposal method would **not** be suitable for high level waste.

.....

..... [1]

(b) One method of disposing of intermediate level waste is to bury it deep underground. Many people who live near to deep disposal sites are unhappy about this.
Suggest scientific reasons why they may be worried about the risks from deep disposal.
In your answer, you should take account of the **chance** of a serious accident or leak, and the **consequence** if it did.

.....

.....

.....

.....

.....

..... [3]

(c) People who work with radioactive materials are at risk from contamination and irradiation.

(i) Explain the meaning of contamination.

.....

..... [1]

(ii) Irradiation is when the worker is exposed to the radiation from the waste.

Suggest and explain one method of reducing the irradiation risk to a worker.

.....

.....

..... [2]

(iii) The radioactive materials in the reprocessing plant give out alpha, beta and gamma radiation.
Explain why gamma radiation is the most serious source of irradiation risk.
In your answer, you should include the effect of this radiation on living things.

.....

.....

.....

..... [2]

(d) The article states 'there are strict laws in place to ensure the safety of these workers'.

(i) Suggest and explain one way in which the managers of the reprocessing plant can make sure that their workers are kept safe.

.....

.....

..... [2]

(ii) State what is meant by the ALARA principle, and explain how it applies to the nuclear reprocessing plant.

.....

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..... [2]

[Total: 14]

3 Many mouthwashes are antibacterial. This means they kill bacteria.
Ellen decides to investigate three different antibacterial mouthwashes to see which is be... killing bacteria.
She uses the following equipment:

- four Petri dishes labelled **A**, **B**, **C** and **D**, each containing nutrient jelly covered with bacteria
- three small circles of paper, each soaked in one of the antibacterial mouthwashes
- one small circle of paper soaked in distilled water
- a ruler

Where the bacteria are growing, the nutrient jelly is cloudy.

Where the bacteria have been killed, the nutrient jelly is clear.

Ellen obtains the following results from her experiment:

Petri dish	total area of clear nutrient jelly at start of experiment /cm^2	total area of clear nutrient jelly at end of experiment /cm^2
A	0	3
B	0	0
C	0	2
D	0	8

(a) Describe how Ellen carried out her experiment to obtain the results shown in the table.

.....

.....

.....

.....

.....

..... [3]

(b) Suggest two variables that Ellen controlled in her experiment to make valid comparisons between the different mouthwashes.

1. .....

2. ..... [2]

(c) **(i)** Why was a circle of paper soaked in distilled water used in this experiment?

.....

..... [1]

(ii) Which of the Petri dishes, **A**, **B**, **C** or **D**, contained the circle of paper soaked in distilled water?

..... [1]

(iii) Explain your answer to **(c)(ii)**.

.....

..... [1]

(d) What conclusions can Ellen make from her results?

.....

.....

.....

..... [2]

[Total: 10]

4 A scientist compares how much two different polymers, **A** and **B**, stretch under tensio
He uses one 5 cm × 1 cm strip of each polymer.
The list shows apparatus that is on a bench in his laboratory.

250 cm^3 beaker

filter funnel

500 g mass

25 cm^3 measuring cylinder

15 cm ruler marked in 1 cm divisions

stand and clamp

(a) (i) Choose from the list the pieces of apparatus the scientist should use to carry out this investigation.

Write down your choices.

.....

.....

..... [2]

(ii) Describe how the scientist should carry out this investigation.

.....

.....

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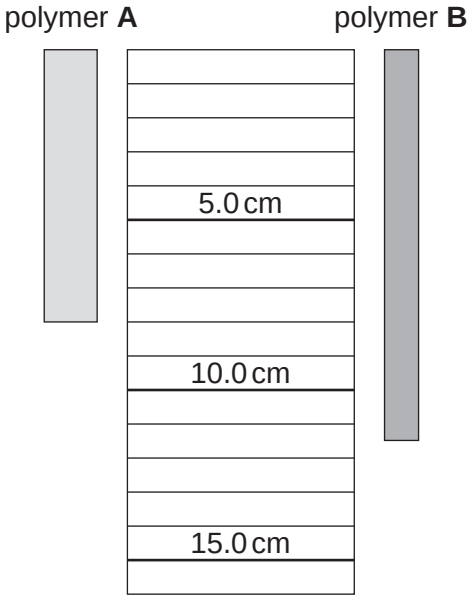
.....

..... [3]

(b) At the start of the experiment, each polymer strip was 5 cm long.
The diagram shows the two polymer strips after they have been stretched.



How far has each polymer stretched?

polymer **A** ..... cm

polymer **B** ..... cm [2]

(c) **(i)** Suggest how the scientist could improve the accuracy of his measurements by using a different piece of apparatus.

.....

..... [1]

(ii) Suggest and explain how the scientist could improve the reliability of his results.

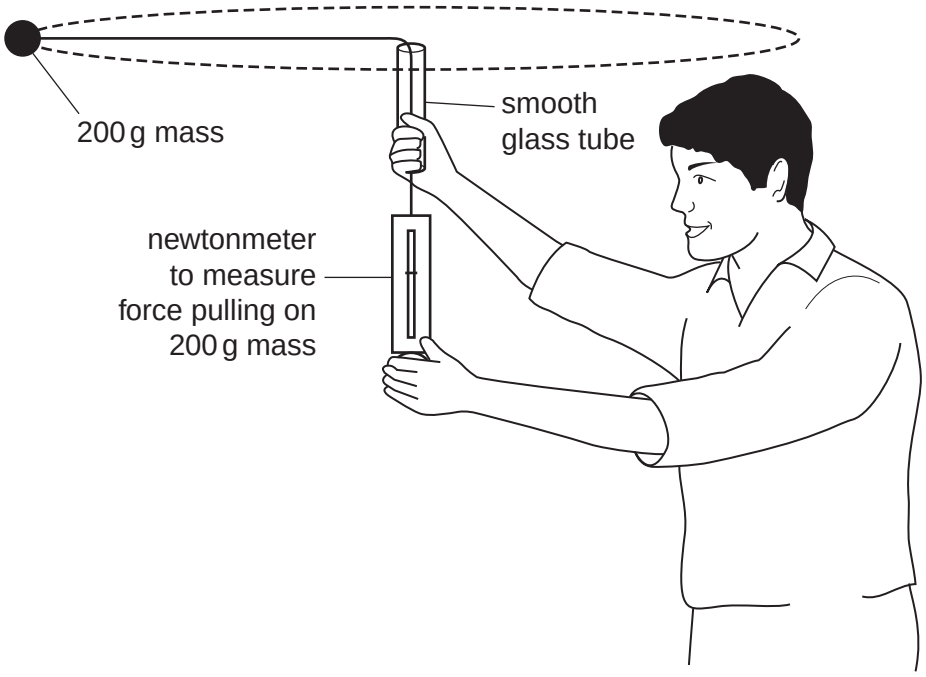
.....

.....

..... [2]

[Total: 10]

5 Two students are using a model to investigate the orbits of planets around the Sun.
Dean rotates a 200 g mass on a nylon cord in a circle as shown in the diagram.
He measures the force which is pulling inwards on the 200 g mass.
He and Nita are going to find the time for one orbit for different values of force.



(a) Nita measures how long it takes the 200 g mass to go around ten times.

What will Nita use to measure the time?

.....[1]

(b) Nita measures the time taken for ten orbits of the mass.
She repeats this five times while Dean keeps the mass moving at a steady speed.
Her results are shown in the table.

Calculate the mean (average) of these results and put your value in the table.

measurement number	1	2	3	4	5	mean
time for ten orbits / seconds	8.8	9.3	9.1	8.7	9.1	.....

[2]

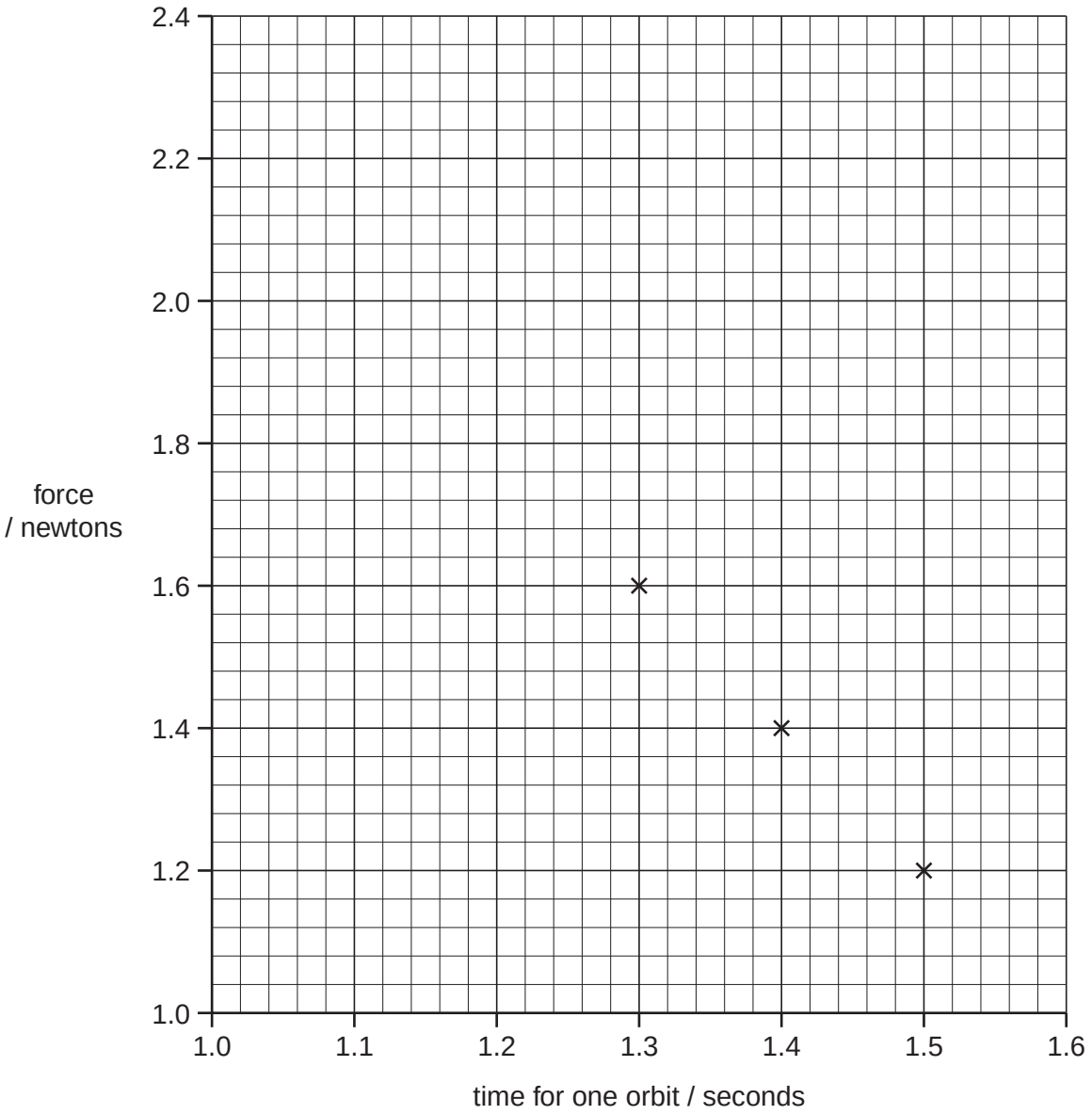
(c) Nita and Dean do the experiment again with the mass moving faster.
Suggest **one** factor that they must keep the same.

[1]

(d) Nita and Dean obtained these results for five different speeds of rotation.

time for one orbit / seconds	1.1	1.2	1.3	1.4	1.5
force / newtons	2.3	1.9	1.6	1.4	1.2

(i) Plot these data on the graph below.
Three points have been plotted for you.
Draw a best-fit smooth curve.



[3]

(ii) Use the graph to find the time for one orbit when the force is 1.3 newtons.

time = ... seconds [1]

Turn over for the last part of question 5

(iii) The graph shows a relationship between force and time for one orbit.
Describe this relationship.

.....

.....

.....[2]

[Total: 10]

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