Candidate Name	Centre Number	Candidate Number
		0

General Certificate of Secondary Education

672/02

GCSE IN APPLIED SCIENCE (Double Award)
Unit 2: Science and Society
HIGHER TIER (Grades D-A*)

P.M. FRIDAY, 18 January 2008

(1 hour 15 minutes)

For Examiner's use only	
Section A	
Section B	
Total	

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

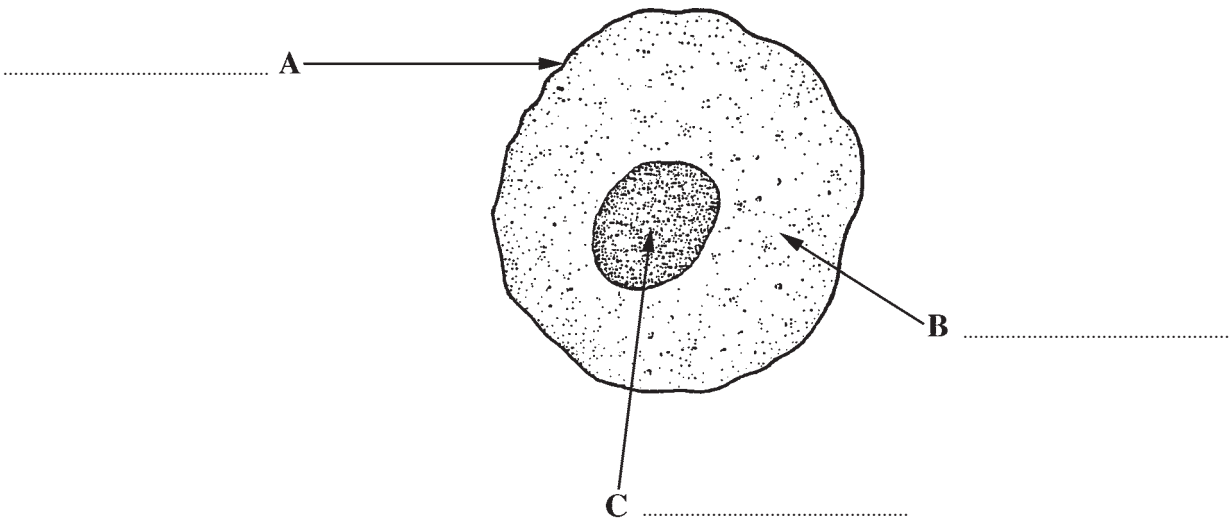
You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

SECTION A (40 marks)

Answer **all** *the questions in the spaces provided.*

1. (i) Label the parts **A**, **B** and **C**, of an animal cell on the diagram below. [3]



(ii) **Name** the part of the cell in which DNA is found. ..... [1]

2. The table shows the blood sugar levels of two boys over a period of 12 hours.

	Blood sugar (units)	
Time	**Tom**	**Jason**
4.00	8	5
6.00	6	5
8.00	18	6
10.00	2	5
12.00	8	6
14.00	22	6
16.00	18	5

(a) Give **one** reason why the data shows that Tom is a diabetic. [1]

.....

.....

(b) (i) Give **one** reason why Tom's blood sugar levels rose at 8.00 and 14.00. [1]

.....

(ii) **Explain** why Tom's blood sugar level increased by a large amount at these times. [2]

.....

.....

(c) If a person's blood sugar level falls below 4 units then they may suffer a "hypo".

(i) At what time did Tom suffer a "hypo"? [1]

.....

(ii) What could have caused his blood sugar level to drop so low that a "hypo" occurred? [1]

.....

(iii) What should Tom do to recover quickly from his "hypo"? [1]

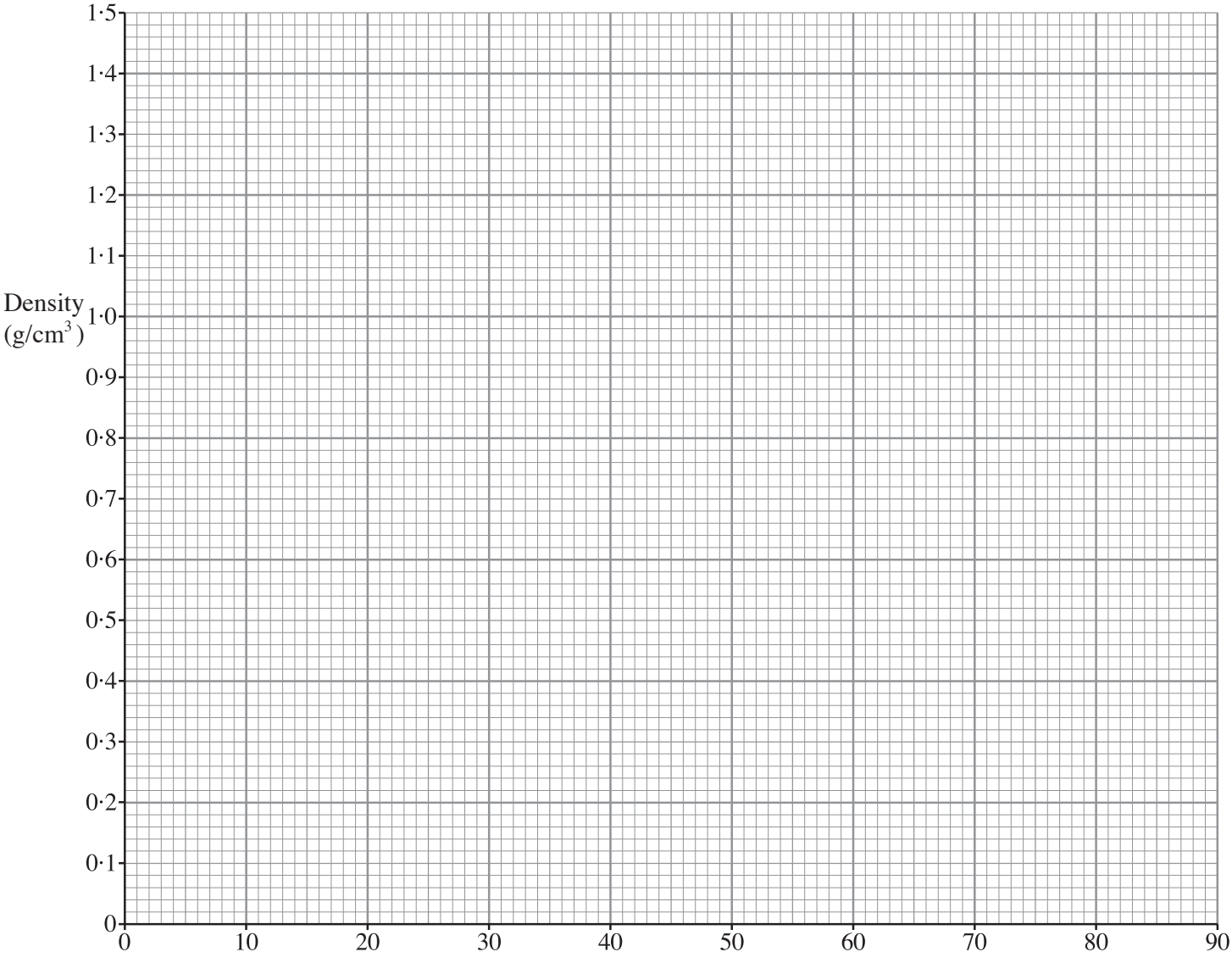
.....

Examiner only

3. The table gives some information about the first four elements in Group 1 of the periodic table. Use this information to answer the questions that follow.

Element	Number of particles in the nucleus	Number of electrons in orbits around the nucleus	Density (g/cm^3)
Lithium	7	3	0.53
Sodium	23	11	0.97
Potassium	39	19	0.86
Rubidium	85	37	1.50

(a) (i) On the grid below, plot a graph to show how the density of the element depends on the number of particles in the nucleus. Draw a line of best fit. [3]



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(ii) It was expected that elements with more particles in the nucleus would have a bigger density.
Explain whether or not the data agrees with this expectation. [2]

.....

.....

(b) The electronic structure of a sodium atom can be shown as **2, 8, 1**.

(i) Write down the electronic structure of potassium. ..... [1]

(ii) Give **one** reason why sodium and potassium have similar chemical properties. [1]

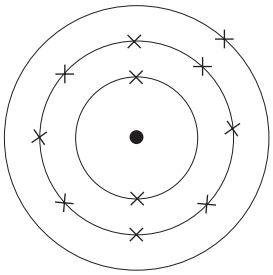
.....

(iii) From the table, state the name of the most reactive element. [1]

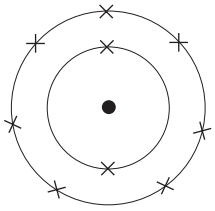
.....

(c) Sodium reacts with fluorine to produce sodium fluoride.
The electronic structures of a sodium and fluorine atom are shown below.

Sodium



Fluorine



(i) **Describe** how the electronic structure of the sodium and fluorine atoms changes during the reaction. [2]

.....

.....

(ii) **Explain** why this causes the atoms to bond together. [2]

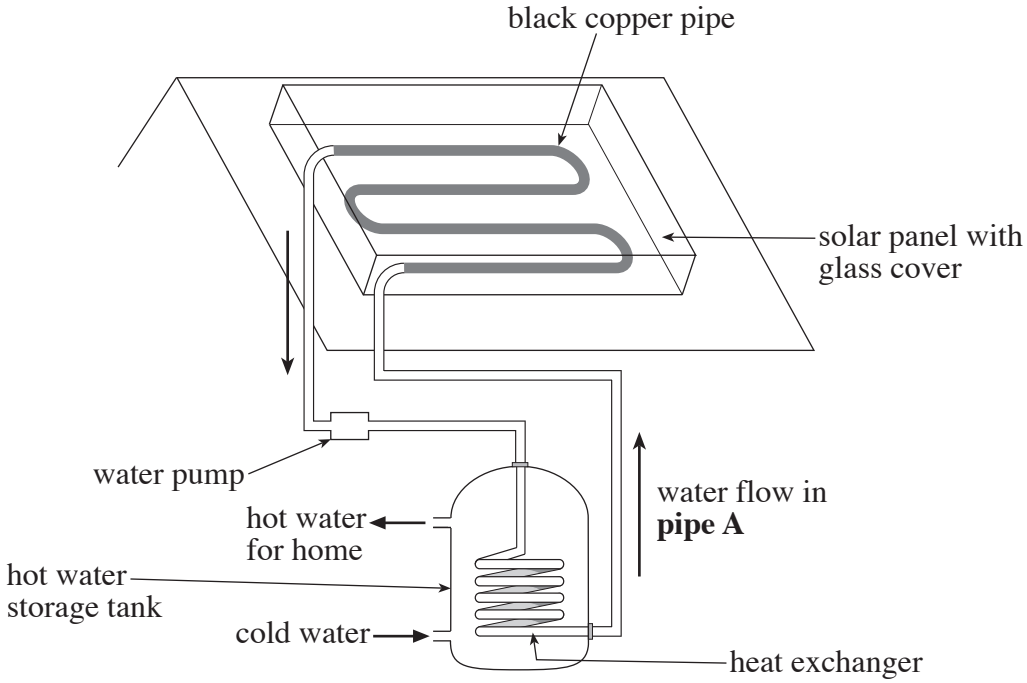
.....

.....

(iii) Complete the symbol equation below that shows this reaction. [2]

$$2Na + F_2 \longrightarrow \text{.....}$$

4. A company advertises solar panels that are fitted onto the roofs of houses.
They claim that they will reduce heating costs in homes.
The solar panel system is shown in the diagram below.



(a) During the summer, 4000 J per second of energy from sunlight falls on the solar panel.
The amount of useful energy transferred to heating the water is 1600 J per second.

(i) Work out how much energy from the sunlight is wasted per second. [1]

Energy wasted = ... J/s

(ii) Use the equation

$$\text{Efficiency} = \frac{\text{useful energy output} \times 100\%}{\text{energy input}}$$

to calculate the efficiency of the energy transfer from sunlight to water. [2]

Efficiency = ... %

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(b) The solar panels have a **glass cover**.
The pipes are **painted black**.
The pipes are placed in a **polystyrene base**.

(i) Give **one** reason why the pipes are painted black. [1]

.....

(ii) Give **one** reason why the solar panel has a glass cover. [1]

.....

(iii) Give **one** reason why the pipes are placed in a polystyrene base. [1]

.....

(c) Water heated in the solar panel flows into a heat exchanger inside a hot water tank.
The water inside the tank becomes heated up to provide hot water for the house.

(i) Give **one** reason why the heat exchanger is made from copper. [1]

.....

(ii) State **one** way of reducing heat loss from the hot water tank. [1]

.....

(iii) Give **one** reason why **pipe A** does not need to be insulated. [1]

.....

(d) Before the solar panel was fitted to the roof, a 3000 W immersion heater heated water for the house.
The immersion heater was switched on for 30 hours a week.

(i) Use the equation

Energy used (kWh) = power (kW) × time (h)

to calculate the energy used by the immersion heater in 30 hours. [2]

Energy used = ... kWh

(ii) Use the equation

Total cost = energy used (kWh) × cost per unit (p)

to find the cost of using the immersion heater for 30 hours.
One unit of electricity costs 8p. [2]

Total cost = ...

(iii) After the solar panel was installed, the immersion heater was only used for 5 hours a week. Calculate how much the homeowner saved in a week. [2]

Saving = ...

SECTION B (40 marks)

Answer **all** *the questions in the spaces provided.*

5. Cystic Fibrosis is caused by a single faulty recessive allele **r**.
A father who is **not** a carrier, and a mother who **is** a carrier of the disease but does not suffer from it, plan to have more children.

(a) (i) Complete the information in the table below. [2]

		Allele pair
Father	Non carrier	.....
Mother	carrier	.....

(ii) Complete a Punnett square to find the chance of a child being born with cystic fibrosis. [3]

Chance = ...

(iii) Neither of the mother's parents suffered from cystic fibrosis. State the allele pair of her mother if her father's allele pair was RR. ..... [1]

(b) Sufferers from cystic fibrosis produce thick secretions that affect the lungs and digestive tract. This causes coughs, chest infection and difficulty in digesting food. **Explain** why sufferers are often tired and lacking in energy. [3]

.....

.....

.....

.....

6. *(a)* The picture shows chickens in a commercial battery farm.

The arguments for this type of intensive farming are shown in the table below. Give the corresponding arguments against. [5]

For	Against
large numbers of chickens kept in 'ideal' conditions for growth	....
growth-promoting chemicals (hormones) boost meat production	....
high-protein foods boost meat production	....
frequent use of drugs (eg antibiotics) keeps animals healthy	....
transport of live chickens to slaughter means meat is fresh	....

(b) Another type of intensive farming involves the use of artificial fertilisers and pesticides.

(i) **Explain** why the use of artificial fertilisers can have harmful effects on fish living in rivers. [3]

.....

.....

.....

(ii) **Explain** the effect of pesticides on animals in a food chain. [2]

.....

.....

7. Railway engineers use **a reduction and exothermic** reaction to weld tracks together.

(i) Explain clearly what happens in **a reduction reaction**. [2]

.....

.....

(ii) State the meaning of the term **an exothermic reaction**. [1]

.....

.....

(iii) Use the following information to write a balanced symbol equation for the reaction.

Iron oxide (Fe_2O_3), aluminium (Al), iron (Fe), aluminium oxide (Al_2O_3)

Iron oxide + aluminium $\longrightarrow$ iron + aluminium oxide [3]

.....

8. *(a)* Many scientists believe that global warming is causing temperatures on the Earth to increase. They say global warming is caused by an increase in carbon dioxide in the atmosphere. State **two** processes that will cause the concentration of carbon dioxide in the atmosphere to increase. [2]

1. .....

2. .....

(b) This headline and story appeared in the newspaper.

The Battle of Newquay: Green lobby launches war to curb domestic flights

Next Tuesday, a British Airways 737 jet will begin its short flight from London to Newquay. The 260-mile flight will be the first of a daily service for 150 passengers to the popular Cornish resort. Campaigners say the case for reducing our air miles is more urgent than ever. Environmentalists argue planes produce more carbon dioxide than trains. They claim aviation emissions are rising so fast that Britain will fail in its bid to keep global warming within safe limits.

The table below shows what the newspaper claims is the carbon cost of making the journey from London to Newquay by three different methods.

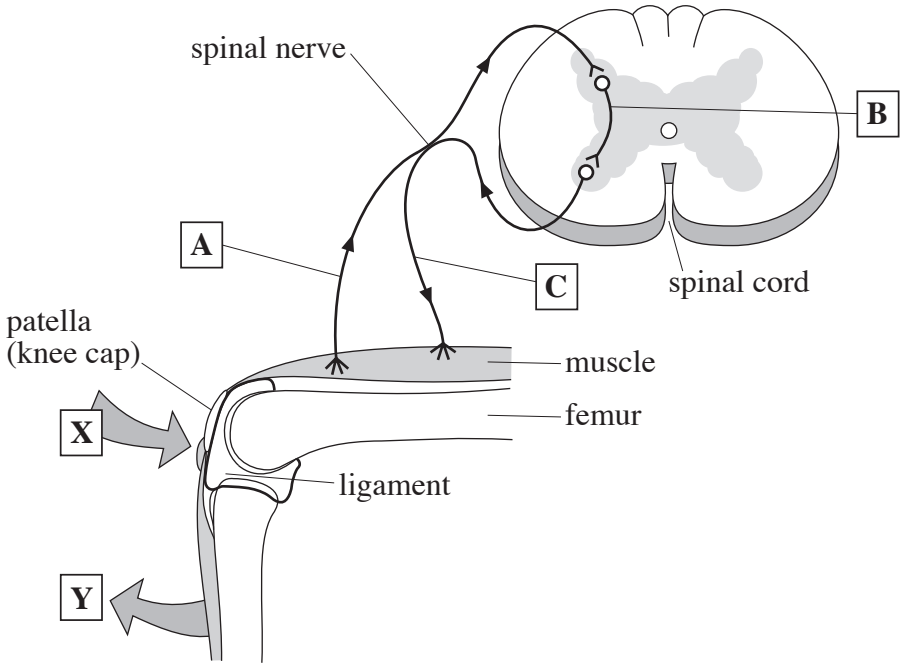
Transport method	Carbon cost (kg)
Aeroplane	100
Car	80
Train	20

(i) Show that the carbon cost **per person** to the environment is less if the journey is made by a fully occupied aeroplane than by a car containing four passengers. [3]

(ii) How many passengers would have to travel on the train so the carbon cost per person is the same as for a fully occupied aeroplane? [2]

Number of passengers = ...

9. The diagram shows a reflex arc.



(i) **Name** the nerves **A**, **B** and **C**. [3]

A .....

B .....

C .....

(ii) A doctor checks the reflexes of a patient by tapping the knee sharply at **X** which should result in the lower leg **Y** moving up quickly.
Explain how the tap on the knee results in the lower leg moving up. [5]

.....

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.....

.....

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