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| Candidate Name | Centre Number | Candidate Number |
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GCSE

672/02

APPLIED SCIENCE

(Double Award)

Unit 2: Science and Society

HIGHER TIER

A.M. THURSDAY, 5 June 2008

1¼ hours

| 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.

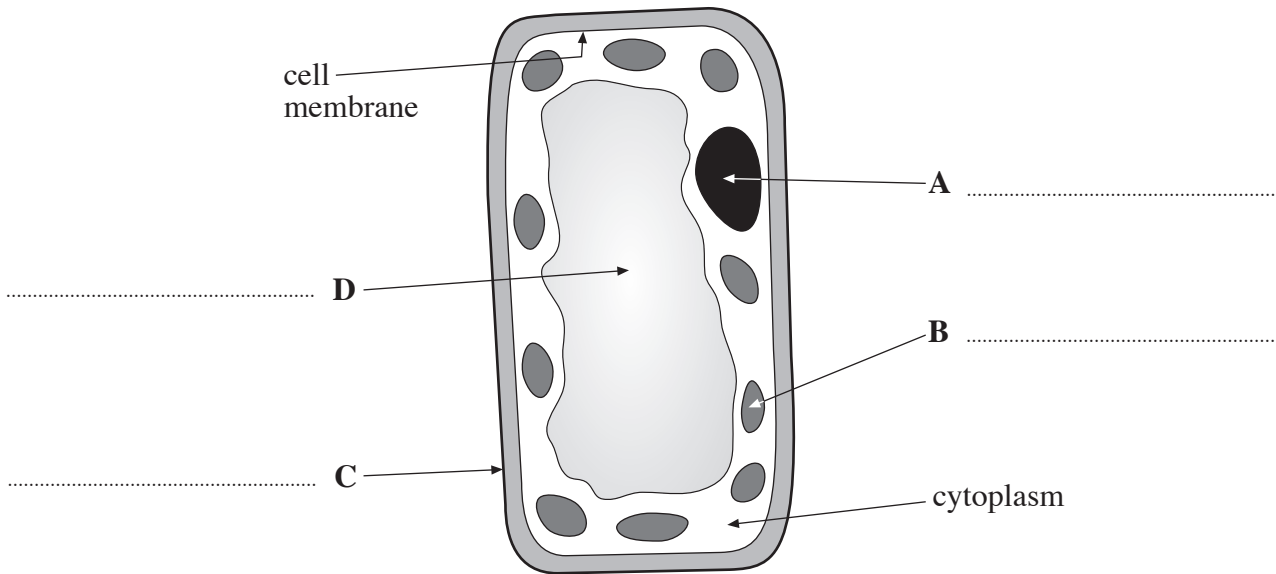
You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

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SECTION A (40 marks)

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

1. The diagram shows a plant cell.



(a) (i) **Label** the parts of the diagram A, B, C and D. [4]

(ii) Name **two** structures that are found in animal cells. [2]

1.

2.

(b) Green plants make glucose by photosynthesis.

(i) Name the structure in the cell above that absorbs sunlight. [1]

(ii) Name the **two** raw materials plants need to make glucose. [2]

1.

2.

(iii) Name the waste product produced by plants during photosynthesis.

..... [1]

2. The MMR vaccine has been successful at protecting children from three diseases caused by viruses.

(a) One of these diseases is rubella.

(i) Name the other **two** diseases. [2]

1.

2.

(ii) Explain how the vaccine helps prevent illness from the viruses. [2]

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(iii) Give **one** reason why rubella cannot be treated with antibiotics. [1]

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(b) Some parents are concerned there is a risk that their children could become very ill if given the vaccine.

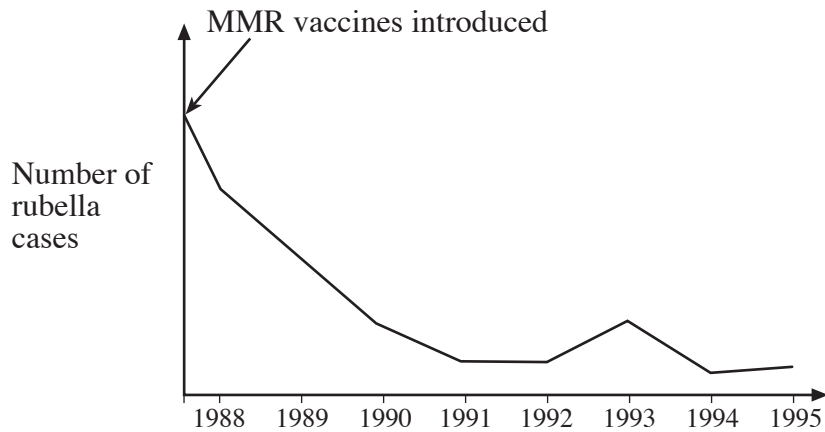
The NHS provided some information comparing the risks of using the vaccine and not using it.

| Condition | Rate after natural disease | Rate after first dose of MMR |
|--|---|------------------------------|
| Convulsions | 1 in 200 | 1 in 1,000 |
| Meningitis/Encephalitis | 1 in 200 to 1 in 5,000 | Less than 1 in 1,000,000 |
| Conditions affecting blood clotting | 1 in 3,000 | 1 in 24,000 |
| Severe allergic response (anaphylaxis) | – | 1 in 100,000 |
| Deaths | 1 in 2,500 to 1 in 5,000 depending on age | 0 |

Use this information to give **three** reasons why parents should get their children vaccinated. [3]

- 1.
- 2.
- 3.

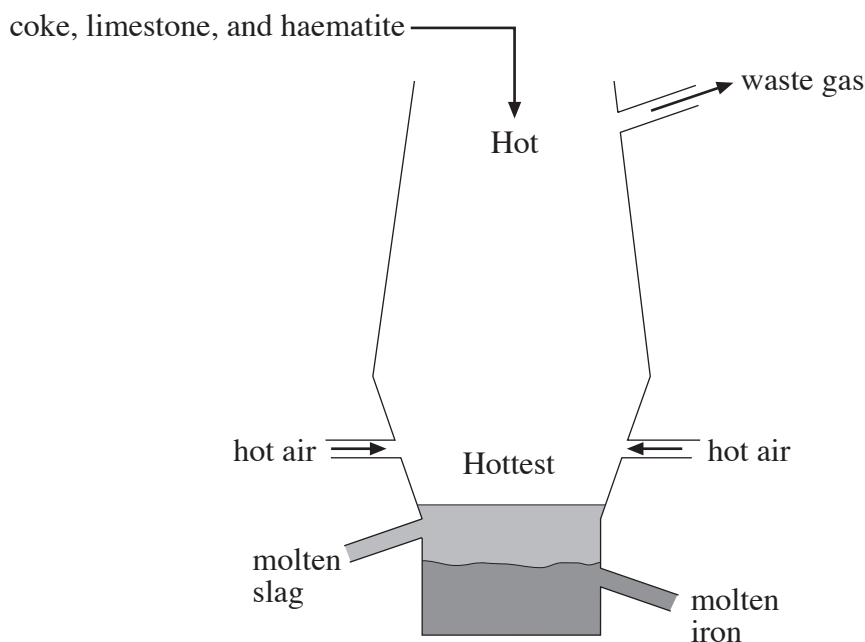
(c) The graph shows how the number of children suffering from rubella changed after the MMR vaccine was introduced.



- (i) If parents decide not to give their children the MMR vaccine, state what is likely to happen to the number of rubella cases in this country. [1]
.....
- (ii) Give **one** reason for your answer. [1]
.....

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3. Iron has many uses.
It is extracted from its ore in a blast furnace as shown below.



- (a) The table shows some information about the raw materials used in the process.
Fill in the gaps. [3]

| Raw material | Chemical name | Symbol or formula | Type of material |
|--------------|-------------------|-------------------|------------------|
| haematite | iron oxide | | compound |
| coke | | C | element |
| limestone | calcium carbonate | CaCO ₃ | |

- (b) In the blast furnace there are several chemical reactions taking place that result in iron being extracted. The coke burns with oxygen to produce carbon dioxide. This reaction is **exothermic**. The CO₂ then reacts with more coke to give carbon monoxide. Carbon monoxide reacts with the iron oxide to give molten iron, which trickles to the bottom of the furnace where it is collected. Carbon dioxide is also produced as a waste gas.

- (i) State what happens in an **exothermic** reaction. [1]

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- (ii) Give **one** reason why an exothermic reaction is important in this process. [1]

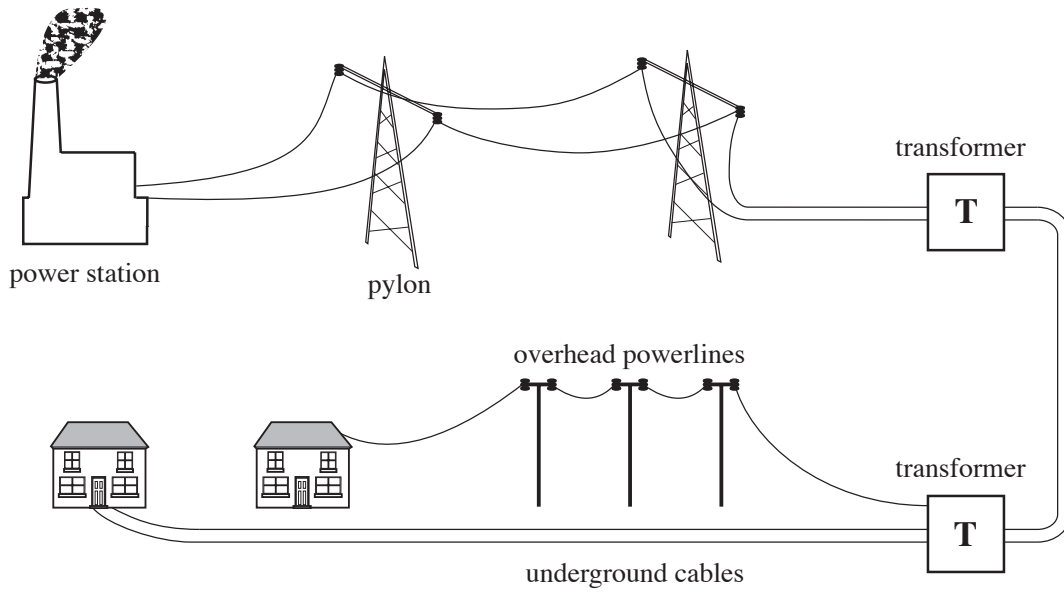
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- (iii) Using the information given, complete the word equations below. [3]

carbon dioxide + → carbon monoxide

carbon monoxide + → iron +

4. The diagram shows part of the national grid system in this country.



(a) (i) Explain why a national grid system is needed. [2]

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(ii) Give **one** reason why electricity is sent across the country at high voltages. [1]

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(iii) State the purpose of transformers (T) in the grid. [1]

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(b) Electrical energy can be sent along overhead wires or underground cables.

(i) State **two** advantages of using overhead wires. [2]

1.

.....

2.

.....

(ii) State **two** advantages of using underground cables. [2]

1.

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2.

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(c) In one power station, the energy stored in coal is used to produce electricity. When 20 kg of coal is burned, it releases 60 000 000 J of energy.

(i) Calculate the energy in 1 kg of coal. [2]

Energy in 1 kg of coal = J

(ii) When 1 kg of coal is burned in the power station, 1 200 000 J of electrical energy is produced. Use the equation below to calculate the efficiency of the energy transfer. [2]

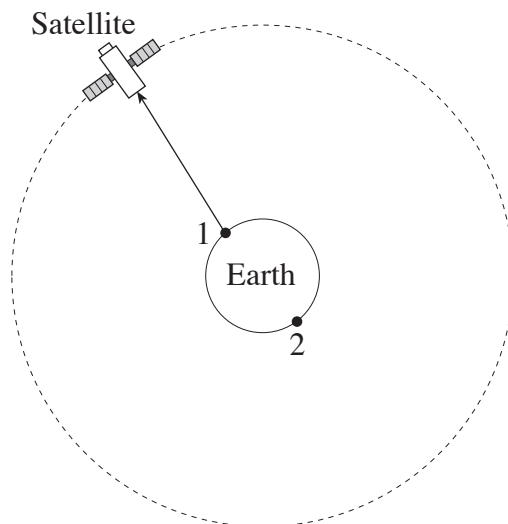
$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100\%$$

Efficiency = %

SECTION B (40 marks)

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

5. (a) The diagram shows a satellite in geostationary orbit around the Earth.



- (i) Explain clearly what is meant by a geostationary orbit. [2]

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- (ii) Name the type of electromagnetic radiation that is used to communicate between the Earth and satellites. [1]

- (iii) By adding to the diagram above, explain how a radio station at position 1 on the Earth can communicate with a radio station at position 2. [4]

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- (b) Over short distances, signals are sent as electric currents through copper wires.

- (i) Explain why the metal copper is a good conductor. [2]

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(ii) Copper can be rolled out into long cables because it is malleable. Explain in terms of its structure, why copper is malleable. [2]

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(c) (i) Over longer distances, signals are increasingly being carried along optical fibres instead of copper wires. Give **two** advantages of using optical fibres instead of copper wires. [2]

1.

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2.

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(ii) Name the type of electromagnetic radiation that is transmitted through optical fibres. [1]

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(d) Optical fibres may be made of plastic or glass.

(i) Plastic is a polymer. Describe the structure of polymers. [2]

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(ii) Glass is an example of a ceramic. State **two** properties of ceramics. [2]

1.

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2.

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6. A farmer bought white sheep from a market for breeding. After a breeding season, he was surprised to find that some of the lambs were black.

- (a) (i) Explain with the aid of a Punnett square how this could happen. Use **R** to represent the allele for white wool and **r** for black wool. [4]

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- (ii) The farmer decided to continue breeding sheep so that all lambs would be black. Explain how and why this could be achieved. [2]

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- (b) (i) During breeding, a gamete from the male sheep fertilises a gamete from the female sheep. The table shows some information about gamete production. Complete the table. [2]

| Sex | Male | Female |
|---|-------|--------|
| Number of chromosomes in nucleus of every cell | 46 | 46 |
| Type of cell division | | |
| Gamete | sperm | egg |
| Number of chromosomes in nucleus of every gamete | | |

- (ii) Explain why, during the process of gamete formation, the genetic information carried by daughter cells is not identical. [3]

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7. (a) As the population increases, there is more demand for extra housing to be built. Explain how this affects biodiversity. [3]

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- (b) More housing also leads to more energy consumption. Owners of terraced houses are being encouraged to reduce their energy consumption. They are provided with the following information;

| SAP rating | Typical annual heating and hot water costs |
|--|--|
| 43 basic gas central heating | £500 |
| 46 windows double glazed | £470 |
| 85 loft insulated and double glazed | £210 |
| 102 loft insulated, double glazed with gas condensing boiler | £160 |

| Fuel | Unit price (p/kWh) | CO ₂ emissions (kg/kWh) |
|-----------------------------------|--------------------|------------------------------------|
| Natural gas | 1.3 | 0.19 |
| Heating oil | 1.6 | 0.27 |
| Bulk LPG | 3.0 | 0.25 |
| Solid fuel (house coal) | 1.7 | 0.29 |
| Electricity (off-peak seven hour) | 2.9 | 0.41 |
| Electricity (on-peak seven hour) | 7.1 | 0.41 |

The Standard Assessment Procedure (SAP) is an energy rating which estimates the space and water heating costs and converts them into a rating on a scale from 1 to 120. The higher the number, the lower the energy consumption.

Use the information above to explain why:

- (i) effective loft insulation should be installed as a priority; [2]

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(ii) switching to natural gas will reduce the homeowner's effect on global warming. [2]

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(c) An increase in the population also puts pressure on farmers to increase food production. This has led to an increase in intensive farming methods including the use of artificial chemicals. Describe how the use of these chemicals affects the ecosystem. [4]

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