

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

652/02

GCSE IN APPLIED SCIENCE (Double Award)

Unit 2: Science for the Needs of Society

HIGHER TIER (Grades D-A*)

A.M. WEDNESDAY, 14 June 2006

(1 hour 30 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.

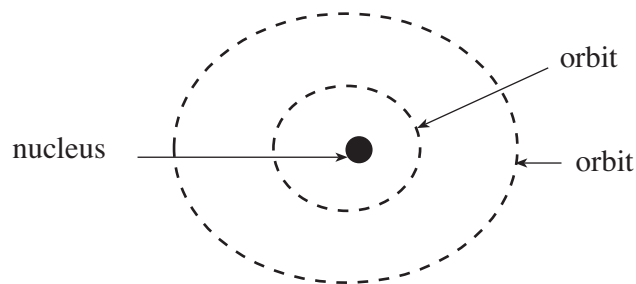
You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

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. The diagram below shows an atom of carbon.



- (a) (i) **Name** the two types of particle found in the nucleus. [2]

..... and

- (ii) An atom of carbon contains **six** electrons.
An electron can be shown as an **X**.
Add **Xs** to the diagram above to show how the electrons are arranged in the orbits. [2]

- (b) Different chemicals are made from different atoms joined together.
The table below shows how atoms are combined for some chemicals.
Fill in the gaps in the table.
The first line has been completed as an example. [4]

Chemical	Formula	Structure
Methane	CH ₄	
Carbon dioxide	
Sulphuric acid SO ₄	
.....	

- (c) (i) Using the table, **name one** bulk chemical. [1]
(ii) Using the table, **name one** organic chemical. [1]

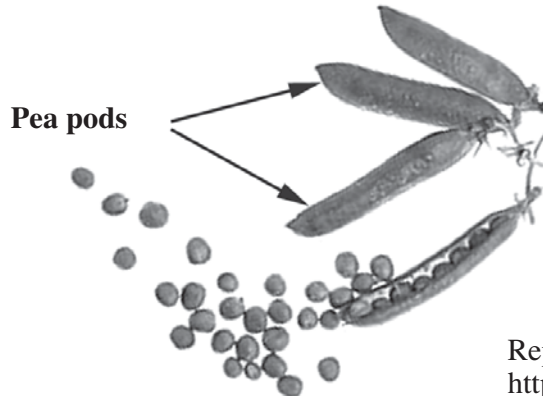
2. Barium (symbol Ba) is a heavy metal.
Its water soluble compounds are highly toxic.
One barium salt, called barium sulphate, is used in hospitals for certain X-ray investigations.
A patient drinks a liquid containing barium sulphate.



Barium sulphate is insoluble in water.
This protects patients from absorbing harmful amounts of the metal.

- (a) The formula for barium sulphate is BaSO_4 .
Name the **two** non-metals that make up barium sulphate. [2]
..... and
- (b) (i) When barium sulphate powder is added to water, it does not dissolve.
Name this type of mixture. [1]
.....
- (ii) Another barium salt, barium carbonate, dissolves when mixed with water.
Name this type of mixture. [1]
.....
- (c) An impurity, such as toxic barium carbonate, dissolves in water and can be absorbed into a patient's body.
Barium carbonate has been accidentally mixed with barium sulphate.
Describe how a hospital technician separates the barium sulphate from the mixture. [3]
.....
.....
.....
.....

3. A gardener noticed that some of his pea pods were yellow, but others were green. He found out that the colour was affected by a gene pair.



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The gene for yellow pods is **Y**.
The gene for green pods is **y**.

- (a) When the gene pair is **Yy**, the pea pods are yellow.
- (i) Write down another gene pair that would give yellow pea pods. [1]
 - (ii) Write down a gene pair that would give green pea pods. [1]
 - (iii) Write down the gene pair that is heterozygous. [1]
- (b) The gardener decided to cross a plant with green pea pods, with a plant with yellow pea pods. He found that half the offspring had green pods, and half had yellow pods. This is shown in the Punnett square (cross diagram) below. Complete the Punnett square to show the parent genes from the plant with yellow pods. [2]

Parent genes	y	y
.....	Yy	Yy
.....	yy	yy

- (c) This effect was first explained by a scientist called Mendel.



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He explained that the features of offspring were determined by **dominant** and **recessive alleles**.

- Using the example of pea pod colour, explain what is meant by **dominant allele**. [1]

.....

.....

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4. Health workers are learning about diseases.
The table shows some information about diseases.

Disease	Caused by	How	Vaccine
E-coli	bacteria	contaminated food and contact with animals	No
Whooping cough	bacteria	through the air – coughs and sneezes	Yes
Tetanus	bacteria	infected soil	Yes
Hepatitis A	virus	contaminated food or water	Yes
Hepatitis B	virus	infected blood	Yes
Hepatitis C	virus	infected blood	No

- (a) **Name two** diseases that could be treated with antibiotics. [2]

..... and

- (b) Give **one** reason why you should not work in the garden if you have an open cut on your hand. [1]

.....

- (c) Nurses, doctors and dentists have vaccinations to protect them from hepatitis B.

- (i) Give **one** reason why they are at risk from becoming infected with the hepatitis B virus. [1]

.....

- (ii) Using the information in the table, give **one** reason why they still need to be careful not to come into contact with blood when treating patients. [1]

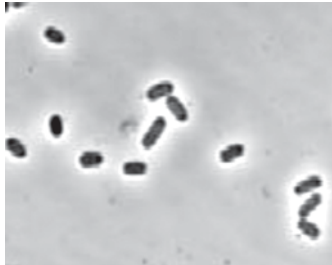
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- (iii) Give **one** way nurses, doctors and dentists can protect themselves from coming into contact with patients' blood. [1]

.....

(d) An infection from E-coli can cause serious illness.

E-coli bacteria



Give **two** precautions that should be taken, when preparing food. [2]

- 1.
.....
- 2.
.....

5. Stores sell different types of ovens.
The table below gives information about three types of ovens.

Type of oven	Power
Conventional / full oven	3 kW
Microwave oven	0.8 kW
Combination microwave & grill oven	Microwave – 0.7 kW Grill – 1.3 kW

All of the ovens are connected to the mains electricity supply of **230 V**.

- (a) Each of the ovens takes a different current when being used.

(i) Write down, **in words**, an equation connecting power, current and voltage. [1]

.....

(ii) One of the ovens takes a current of **3.5 A** when switched fully on. Use your equation to calculate the power of this oven. [2]

Power = W

(iii) Use your answer to name the oven that was probably being used. [1]

.....

- (b) A joint of meat is cooked in the combination oven using the microwave and grill.
Both are switched on at full power for 0.5 hour.

(i) Use the equation:

$$\text{Energy used} = \text{power} \times \text{time}$$

to find the energy used by the combination oven in **kilowatt hours**. [2]

Energy used = kWh

(ii) If electrical energy costs 8p for one kilowatt hour, use the equation:

$$\text{Cost} = \text{energy used} \times \text{cost of one kilowatt hour}$$

to find the cost of using this oven to cook the meat. [1]

Cost = p.

- (c) The same joint of meat would have taken 1.5 hours to cook in the conventional/full oven.
Explain why this would cost more than using the combination oven. [2]

.....

.....

SECTION B (60 marks)*Answer all the questions in the spaces provided.*

6. Resources of North Sea gas will soon run out. Electrical power generation companies must either import gas from other countries, or develop alternative methods of producing electricity.

- (a) Give **one** advantage and **one** disadvantage, other than cost, for **each** of the energy sources in the table below. [6]

Energy source	Advantage	Disadvantage
Gas		
Nuclear power		
Hydroelectric power		

- (b) At present, the power company uses gas fired power stations. Describe the stages involved in generating electricity using gas. [4]

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7. The world population is growing quickly. There is concern that we are not producing enough food to feed all the population. Farmers are being encouraged to use **intensive farming methods**.

(a) (i) Give **two** advantages of intensive farming methods. [2]

- 1.
- 2.

(ii) Give **two** disadvantages of intensive farming methods. [2]

- 1.
- 2.

(b) One method of intensive farming is keeping battery hens.

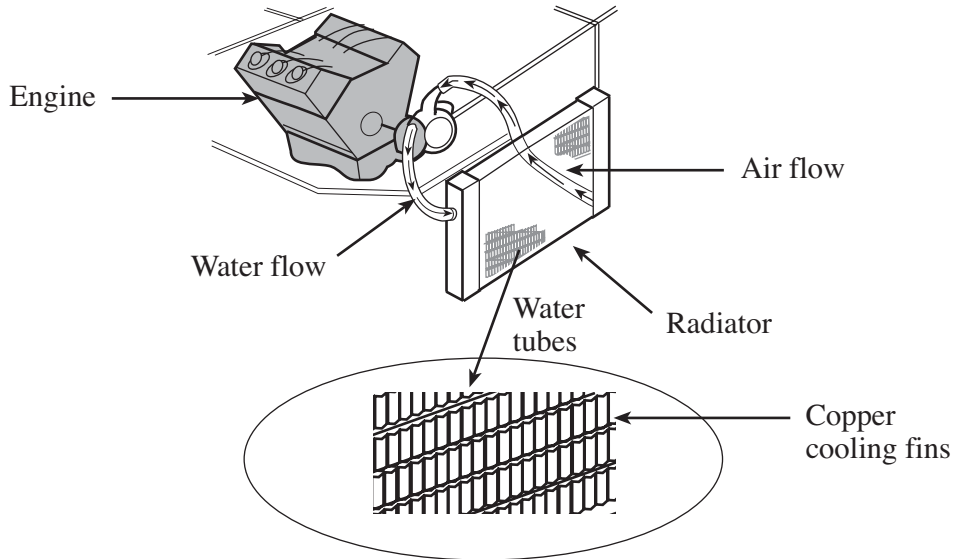


Give **two** reasons why it is cheaper for the farmer to keep battery hens. [2]

- 1.
- 2.

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8. Car engines become very hot when in use. A cooling system is used to prevent overheating.



The copper cooling fins are usually painted **black**. The hot water enters the top of the radiator. The radiator is designed to cool the water before it flows back into the engine.

(a) (i) Give **one** reason why the water circulates in the direction shown by the arrows. [1]

.....

(ii) Explain how the design of the radiator makes water cool efficiently. [3]

.....

.....

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(b) As 1kg of water flows through the engine, it absorbs 4200 J of heat energy for each 1 °C rise in temperature. During one cycle of water flow through the engine, 6 kg of water is heated up by 60 °C.

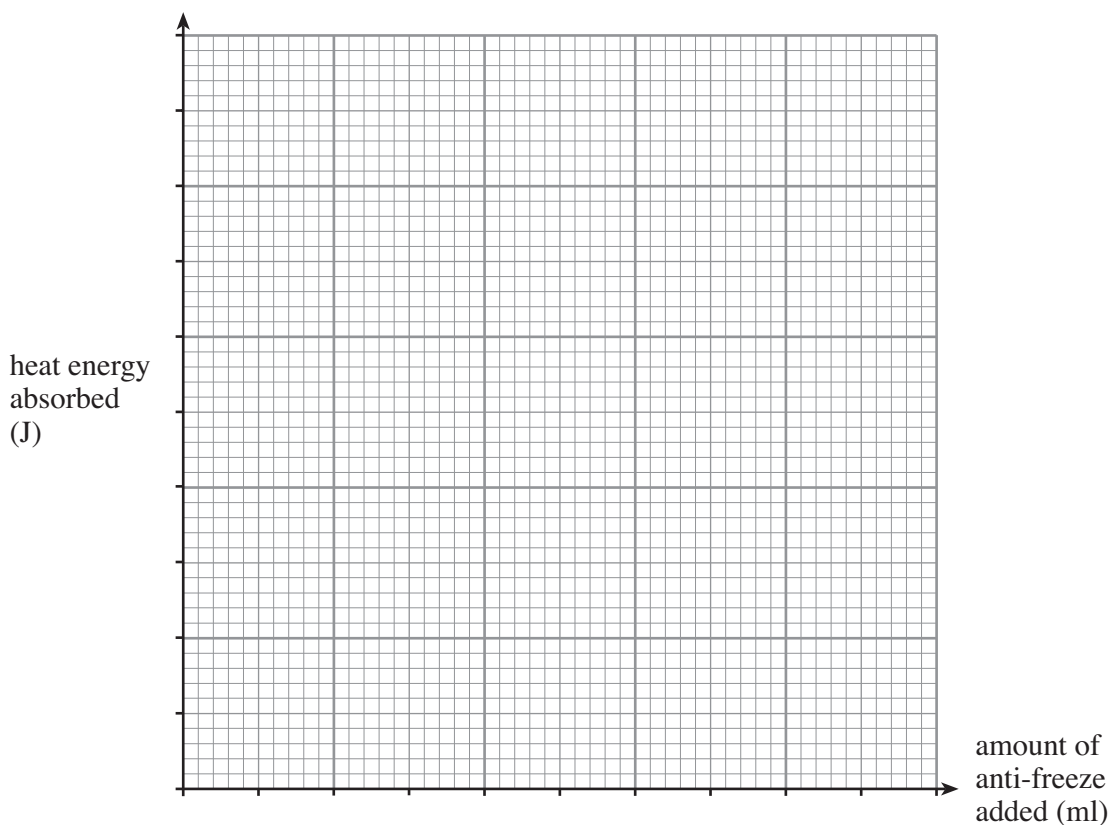
Calculate the heat energy absorbed by the water in one cycle. [2]

Heat energy absorbed = J

- (c) In winter, anti-freeze is mixed with the water. The table shows how the heat energy absorbed by the mixture changes as more anti-freeze is added to the water.

Amount of anti-freeze added to the water (ml)	Heat energy absorbed by 1 kg of mixture for 1 °C rise in temperature (J)
0	4200
500	3600
1000	3100
1500	2700
2000	2400

- (i) Plot these points on the grid and join them with a suitable line. [3]



- (ii) As more anti-freeze is added to the water, it becomes a less effective coolant. **Explain** why this happens. [2]

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9. A group of gardeners grew tomato plants. Pictures of the plants from all gardeners are shown below.



Plant A - healthy



Plant B - poor growth of stem



Plant C - had poor root growth



Plant D - poor development of leaves

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(a) Name the nutrient that was needed for the healthy growth of:

(i) plant B; [1]

(ii) plant C; [1]

(iii) plant D. [1]

(b) Plants make their own food by photosynthesis.

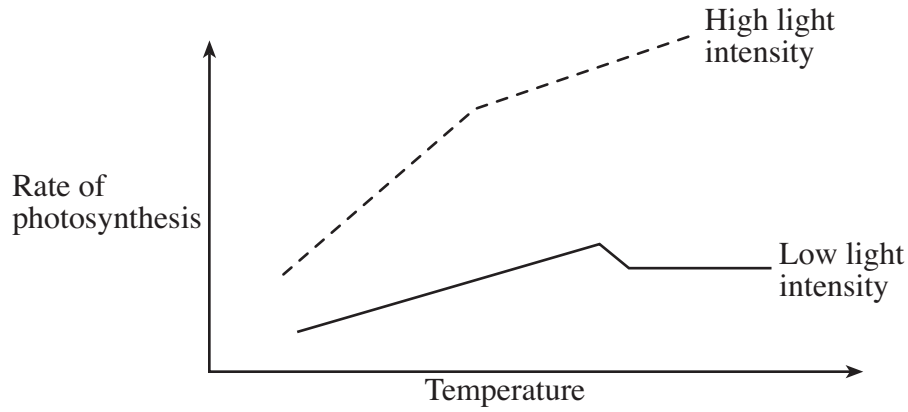
(i) If a plant grew in soil lacking in magnesium, how would this affect the ability of the plant to produce food? [2]

.....
.....

(ii) Complete the equation to show the process of photosynthesis. [2]



(b) The rate of photosynthesis is affected by temperature and light intensity, as shown in the graph below.



(i) **Describe** how temperature affects the rate of photosynthesis at low light intensity. [2]

.....

.....

(ii) **Describe** how temperature affects the rate of photosynthesis at high light intensity. [2]

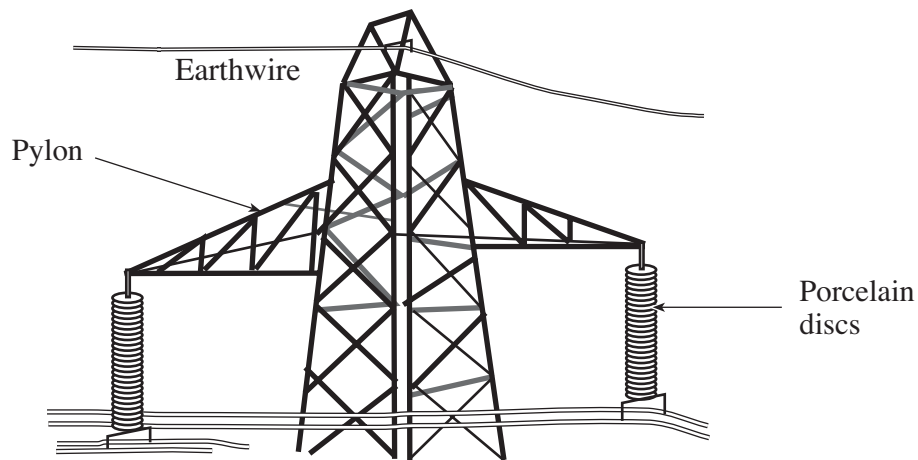
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(iii) **Name one** gas that will also affect the rate of photosynthesis. [1]

.....

10. Different types of materials are used in the national grid system.



(a) The table shows some properties of metals.

Metal	Density (g/cm ³)	Strength (MN/m ²)	Resistance (ohms/m)
Aluminium	2.7	90	3.6
Copper	8.9	120	2.2
Lead	11.3	15	27.0
Steel	7.8	1200	9.8

Use the information in the table to:

(i) give **one** reason why the pylons are made from steel; [1]

.....

(ii) **explain** why the best combination of metals for overhead power cables is aluminium and steel; [2]

.....

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.....

(iii) **explain** in terms of atomic structure, why metals are good conductors of electricity; [2]

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- (iv) **explain** in terms of atomic structure, why metals can be rolled into cables. [2]

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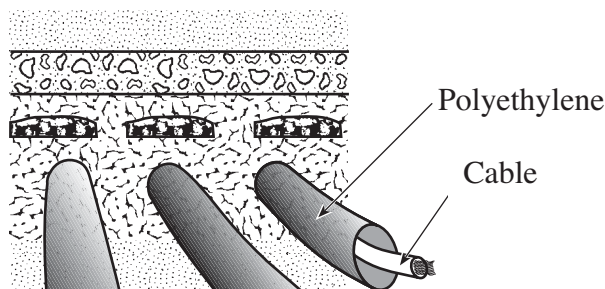
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- (b) Porcelain is an example of a ceramic. Give **one** reason why the cables are hung from porcelain discs. [1]

.....

- (c) Sometimes cables travel underground.



The cables are covered in a tough polyethylene to prevent corrosion. Polyethylene is a polymer. A layer of fluid-soaked paper lies between the polyethylene and cable to act as an insulator.

- (i) Describe the molecular structure of a polymer. [2]

.....

.....

- (ii) The polyethylene is made tougher by adding cross links to the molecular structure. Explain how these make the plastic tougher. [2]

.....

.....

- (iii) The fluid in which the paper is soaked is a substance with covalent bonding. Explain what is meant by covalent bonding. [1]

.....

11. Athletes are learning about how the body reacts during exercise. They are learning about aerobic and anaerobic respiration. They are also learning about the importance of healthy lungs.

(a) The equation for aerobic respiration is:



As an athlete begins to jog, the body needs more energy.
Explain why the heart rate and breathing rate increases.

[2]

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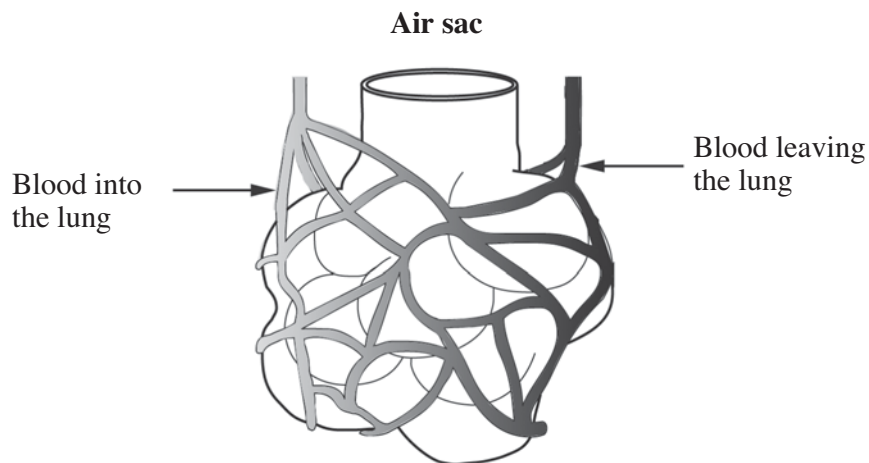
(b) After sprinting for a short while, muscles begin to ache because they are not getting enough oxygen. Respiration becomes anaerobic.

(i) Name the substance that builds up in the athlete’s muscles. [1]

(ii) Anaerobic respiration builds up an oxygen debt. Explain the meaning of oxygen debt. [2]

.....
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.....

(c) Athletes learn that they need healthy lungs because gas exchange takes place in air sacs.



Describe the role of diffusion in the process of gas exchange between blood and the air inside the air sacs. [3]

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