

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

672/02

GCSE IN APPLIED SCIENCE (Double Award)

NEW SPECIFICATION

Unit 2: Science and Society

HIGHER TIER (Grades D-A*)

A.M. WEDNESDAY, 13 June 2007

(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. A health visitor is explaining to schoolchildren how microorganisms can cause disease.



(i) Name **two** types of microorganisms. [2]

..... and

(ii) Name **one** disease caused by microorganisms. [1]

.....

(iii) The health visitor told the schoolchildren they were to be given a vaccination. **Explain** the purpose of giving vaccinations to schoolchildren. [2]

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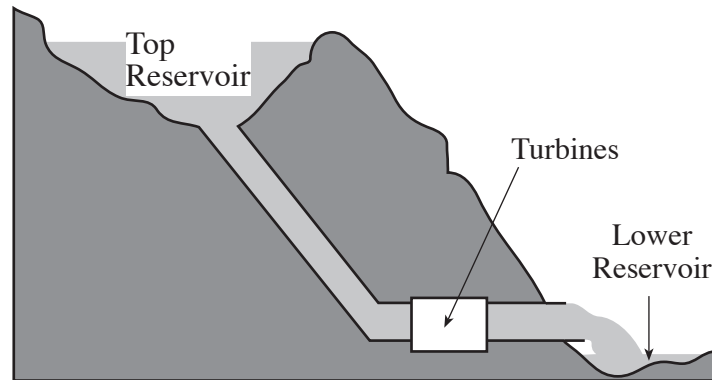
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(iv) The health visitor told the children that some of the types of microorganism that cause illness can be killed by antibiotics.



Name the type of microorganism killed by antibiotics. [1]

2. A power company that generates electricity for the National Grid uses hydroelectric power. The diagram of a hydroelectric power station is shown below.



- (a) Give **two** advantages of using hydroelectric power stations to generate electricity. [2]

(i)

(ii)

- (b) Give **two** disadvantages of building a hydroelectric power station. [2]

(i)

(ii)

- (c) The company is considering building nuclear power stations.

Give **two** reasons why people may object to nuclear power. [2]

(i)

(ii)

3. Read the information in the box below about the ozone layer and ultra violet (UV) radiation. Answer the questions that follow.

Scientists monitor the ozone layer that surrounds the Earth.
 This is because the ozone layer has an important role to play in protecting us from ultra violet radiation from the Sun.
 The Sun produces **UV**, which is split into three bands: **UVA**, **UVB** and **UVC**.
UVA is not absorbed by ozone and is harmful to living organisms.
UVB is also harmful to living organisms but most is absorbed by ozone.
UVC is completely absorbed by ozone.

- (a) (i) State **one** harmful effect of ultra violet radiation. [1]

.....

(ii) State **one** way humans protect themselves from **UV** radiation. [1]

.....

- (b) (i) State **one** reason why the ozone layer does **not** protect us completely from **UV** radiation. [1]

.....

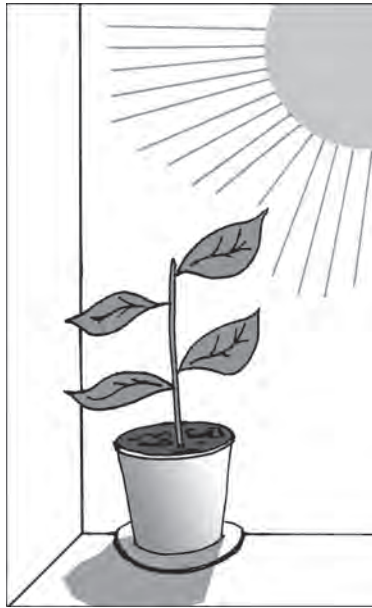
- (ii) **Explain** why a hole in the ozone layer would put living organisms at more risk. [2]

.....

.....

.....

4. A plant scientist is investigating photosynthesis in plants.



- (a) (i) Give **one** reason why plants carry out photosynthesis. [1]

-
(ii) **Name** the part of the plant in which photosynthesis occurs. [1]

-
(iii) **State** the purpose of chlorophyll in photosynthesis. [1]

-
(iv) The scientist decreases the brightness of the light shining on the plant.
State what effect this has on the rate of photosynthesis. [1]

- (b) The photosynthesis reaction is shown by the chemical equation below:



- (i) Name the **two** compounds needed by plants to carry out photosynthesis. [2]

1.

2.

- (ii) Name the gas produced by the plant during photosynthesis. [1]

.....

5. Many children have problems with tooth decay. Dentists believe that fluoride should be added to drinking water to reduce tooth decay. Some people say this will not make any difference.

A study was carried out to find if adding fluoride to water would reduce tooth decay. The findings are shown in the table below.

Country	Tooth decay index	Water type
Australia	0.9	fluoridated
Finland	1.2	unfluoridated
Iceland	1.5	unfluoridated
Ireland	1.4	fluoridated
Netherlands	0.9	unfluoridated
New Zealand	1.5	fluoridated
Sweden	1.0	unfluoridated
United States	1.4	fluoridated

Data adapted from World Health Organization (WHO) Oral Health Country Programme.

- (a) (i) Supporters of adding fluoride to water say that the results for Australia show that the lowest index of tooth decay occurs where fluoride is added to water.

Explain why the results in the table do **not** fully support this view. [2]

.....

.....

- (ii) Opponents of adding fluoride to water say the results for New Zealand show that fluoride makes no difference since their children have the largest index of tooth decay. **Explain** why the results in the table do **not** fully support this view. [2]

.....

.....

(b) Scientists say that they would like more information from the study.

- (i) They would like to know what the tooth decay index was in Australia, Ireland, New Zealand and in the United States before fluoride was added to the water.

Give **one** reason why this information would be useful. [1]

.....

- (ii) They would also like to know whether the results are from a fair test. State **two** ways of making the study a fair test. [2]

1.

2.

6. An electrician was comparing the power produced by different appliances. He took measurements of voltage and current for each appliance. He calculated the power for some of the appliances. These are shown in the table below.

(a) Complete the table.

[2]

Appliance	Voltage in volts	Current in amps	Power in watts	Power in kilowatts
Table lamp	230	0.3	69	0.069
Tumble drier	230	10.0	2300
Hair drier	230	5.0		
Microwave	230	3.0	0.69

(b) The electrical power of a device is given by:

$$\text{power} = \text{voltage} \times \text{current}$$

Use the equation to calculate the power of the hair drier.

[2]

Power = W

(c) The electrician calculated the power of the tumble drier. The tumble drier was used for 30 minutes. Using the equation:

$$\text{energy} = \text{power(kW)} \times \text{time(h)}$$

find the energy used by the tumble drier in **kilowatt-hours**, during this time.

[3]

Energy = kWh

(d) (i) Using the information in the table, **state** which appliance uses the most amount of energy in 30 minutes.

.....

[1]

(ii) Using the information in the table, **state** which appliance uses ten times as much energy as the table lamp in 30 minutes.

.....

[1]

A9

SECTION B (40 marks)

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

7. The chemical industry produces hydrogen chloride in large quantities. The chlorine used in this process is obtained from sodium chloride. Sodium is found in group 1 of the periodic table. Chlorine is found in group 7 of the periodic table.

- (a) (i) **Explain** clearly how a sodium atom bonds with a chlorine atom. [3]

.....

- (ii) Chlorine gas is produced by the electrolysis of sodium chloride solution. The equation for this process is shown below. Balance the equation by putting the correct numbers in the spaces. [3]



- (b) An atom of chlorine can be represented by the symbol ${}^{35}_{17}\text{Cl}$

- (i) **State** the number of electrons in an atom of chlorine. [1]

.....

- (ii) **State** the number of electrons in the outer shell of a chlorine atom. [1]

.....

- (iii) **Draw** a diagram below to show the electronic structure of an atom of chlorine. [3]

8. **Cystic fibrosis (CF)** is a common hereditary disease. **CF** is caused by a mutation in a gene called the **cystic fibrosis regulator (CFR)**. Although most people without **CF** have two working copies of the **CFR** gene, only one is needed to prevent cystic fibrosis. **CF** develops when neither gene works normally. Therefore, **CF** is considered to be a recessive disease. The **CFR** gene is found on chromosome 7.

(a) **Explain** the roles of chromosomes and genes in inheritance. [3]

.....
.....
.....
.....
.....

(b) A sufferer of **CF** will have a gene pair **cc**.

(i) **Write down** the gene pair for a parent who does **not** carry the recessive gene for **CF**.
..... [1]

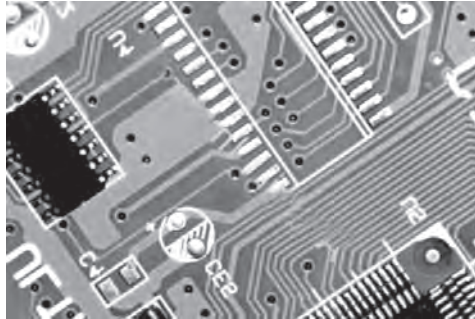
(ii) **Write down** the gene pair for a parent who **carries** the recessive gene for **CF** but who does **not** suffer from **CF**.
..... [1]

(iii) By using a Punnett square, **calculate** the chance of a child being born with **CF**, if both parents **are** carriers of the disease but are **not** suffering from it. [4]

Chance =

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9. An electronics company designs printed circuit boards which consist of copper tracks on a fibre-reinforced board. One circuit board is shown in the picture below.



- (a) Copper is used to make the tracks because it is a conductor and is malleable. **Explain** in terms of its structure, why **copper** is

(i) a very good conductor;

[2]

.....

.....

(ii) malleable.

[2]

.....

.....

- (b) The fibre-reinforced board is made from very thin glass fibres embedded in a polymer base. This combination makes the board hard and firm.

Describe the structure of polymers.

[2]

.....

.....

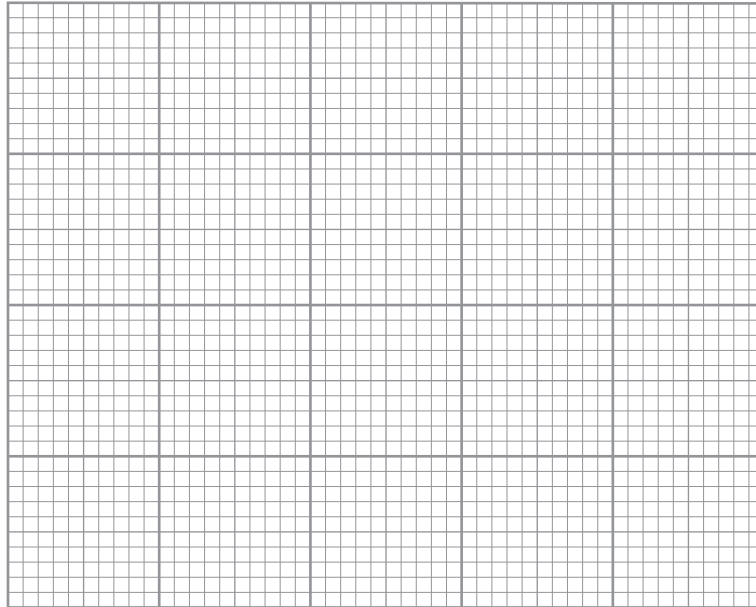
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- (c) The company tests glass fibres before they decide which thickness to use in their circuit boards. The results of the testing are shown in the table below.

Diameter (mm)	Strength (GPa)
0.02	0.80
0.03	0.52
0.04	0.44
0.05	0.40
0.06	0.38

- (i) Plot the points on the grid below and join them with a smooth curve. [3]

**Strength
(GPa)**



Diameter (mm)

- (ii) It was thought that thicker glass fibres would be stronger than thinner ones. **Explain** whether the results support this statement. [1]

.....
.....

- (iii) The company decided that they would use glass fibres with strength of 0.6 GPa. **Find** the diameter of glass fibres that would provide this strength. [1]
- mm.

10. According to the Big Bang theory, the universe emerged from an extremely dense and hot state. Since then, space itself has expanded carrying the galaxies with it.

(a) **Explain** the evidence that supports the Big Bang theory. [3]

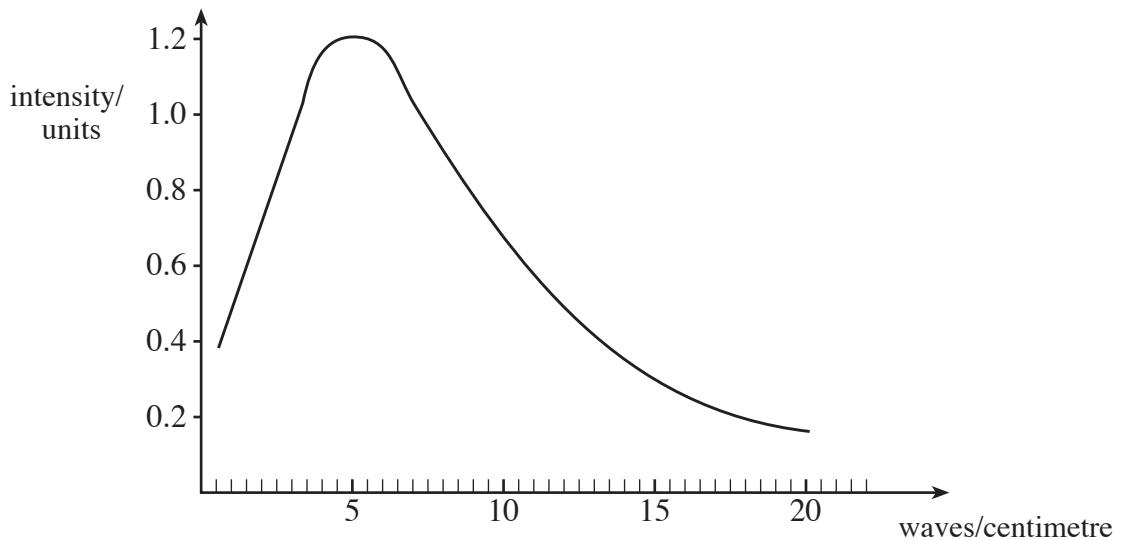
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(b) **Cosmic microwave background radiation** is a form of electromagnetic radiation that fills the entire universe. It was discovered in 1965. Most cosmologists consider this radiation to be the best evidence for the Big Bang theory of the universe. The COBE satellite measured the spectrum of the cosmic microwave background in 1990. The diagram below shows the results plotted in **waves per centimetre** against **intensity**.



(i) State **one** advantage of making observations from a satellite instead of from Earth. [1]

.....

(ii) From the graph **state** the number of waves per centimetre at which the intensity of the microwaves is a maximum. [1]

Number of waves per centimetre =

(iii) **Calculate** the wavelength, in millimetres, of the most intense microwaves. [2]

Wavelength = mm

(c) **Name** the **two** other electromagnetic waves with frequencies higher than ultraviolet that can be detected coming from space. [2]

1.
2.