

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)

(LEGACY SPECIFICATION)

Unit 2: Science for the Needs of Society

HIGHER TIER (Grades D-A*)

A.M. WEDNESDAY, 13 June 2007

(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.

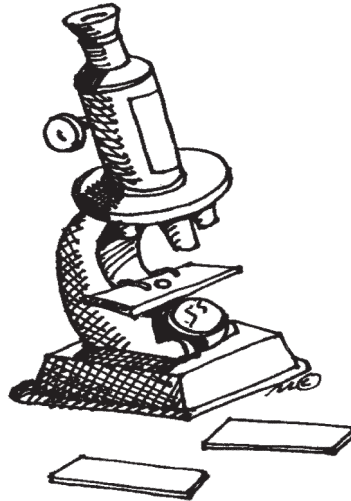
You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

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. A forensic scientist is given a sample to examine.
She must look at the cells under a light microscope to find out if the sample is from a **plant** or an **animal**.



(a) Name **two** structures she would see in **both** plant **and** animal cells. [2]

(i)

(ii)

(b) Name **two** structures that would **only** be seen if the sample was from a **plant**. [2]

(i)

(ii)

2. There are many types of mixtures.
There are solutions, suspensions, gels, emulsions, foams and aerosols.
They are made by mixing different combinations of solids, liquids and gases.

- (i) Complete the table below.
The first row has been completed for you.

[3]

Example	Type of mixture	Mixture made from
Ice cream	Suspension	Solid and liquid
Hair spray	Aerosol	Liquid and
Whipped cream	Foam	Gas and
Sea water	Solution	Solid and

- (ii) **Describe** the **difference** between a solution and a suspension.

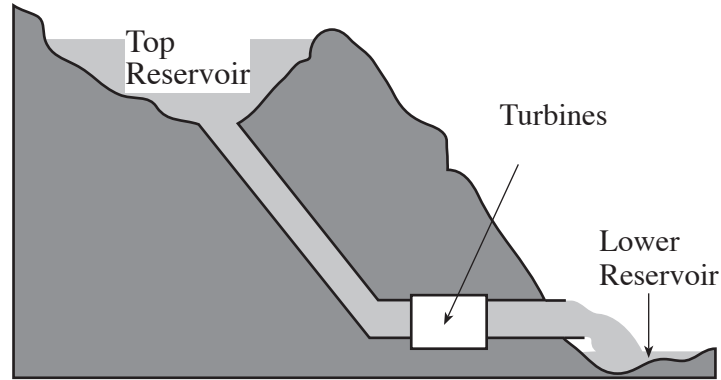
[2]

.....

.....

.....

3. A power company is producing a poster to explain how a hydroelectric power station produces electricity.
The diagram of the power station is shown below.



- (a) Describe how electricity is produced at the power station. [2]

.....

.....

.....

- (b) Give **two** advantages of using hydroelectric power stations **instead of** oil burning power stations to produce electricity. [2]

(i)

(ii)

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

(i)

(ii)

- (d) Electricity can also be produced by nuclear power stations.

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

(i)

(ii)

4. 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]

.....

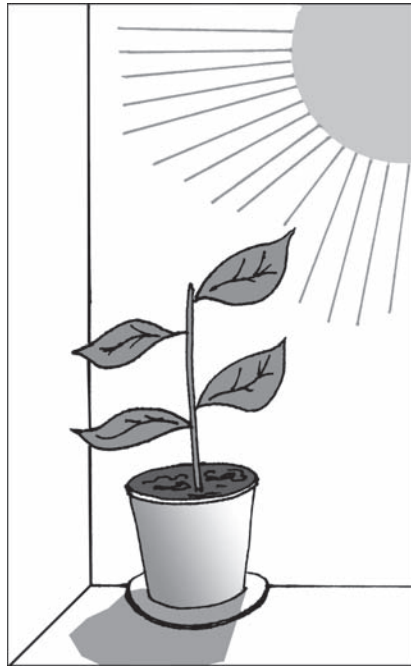
.....

(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]

5. 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]

.....

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

[1]

.....

- (ii) 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]

.....

BLANK PAGE

SECTION B (60 marks)

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

7. A company occupies a building which contains 50 light fittings. At the moment they are all fitted with 100 W filament light bulbs. They believe that replacing these with 20 W low energy lamps will reduce their electricity bills.



FILAMENT LIGHT BULB



LOW ENERGY LAMP

- (a) **Explain why** 20 W low energy lamps are more efficient than 100 W filament light bulbs. [2]

.....

.....

.....

- (b) (i) **Calculate** the cost of using fifty 20 W lamps for 8 hours each day. You may assume that 1 kWh of electricity costs 8p. You may use the following equations. [4]

$$\begin{aligned} \text{number of kWh} &= \text{power in kW} \times \text{time in hours} \\ \text{cost} &= \text{number of kWh} \times \text{cost/kWh} \end{aligned}$$

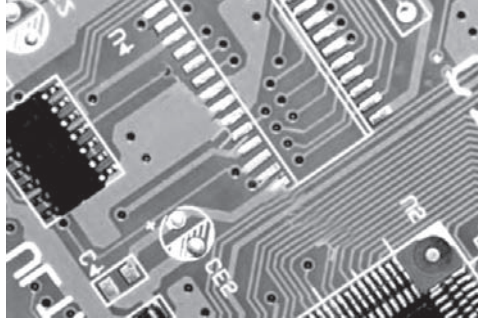
Cost = p

- (ii) The company uses the building for 5 days a week for 40 weeks every year. They have calculated that using the 100 W lamps is costing them £640. How much will the company save by using the 20 W lamps instead? [2]

Saving = £

Turn over.

8. 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]

.....

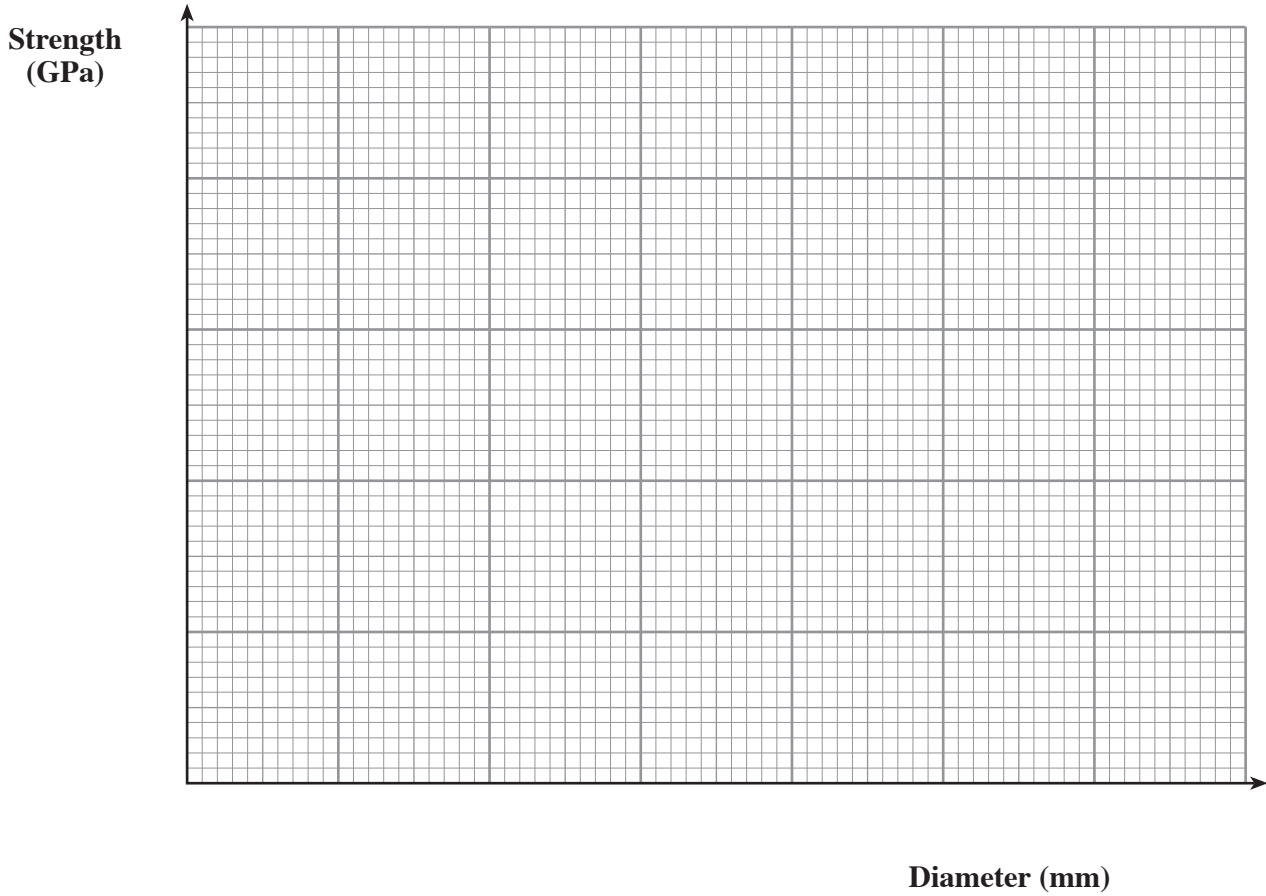
.....

.....

- (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]



- (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.

9. A geneticist is explaining to a family how characteristics are passed from parent to child.

(a) State the meaning of the following terms:

[3]

(i) allele;

.....

.....

(ii) dominant genes;

.....

.....

(iii) homozygous gene pair.

.....

.....

(b) **B** is the gene for brown eyes and **b** is the gene for blue eyes. The geneticist produces a table to show the possible combinations of gene pairs and the eye colour they produce.

	Gene pairs	Eye colour produced
1.	BB	Brown
2.	Bb	Brown
3.	bb	Blue

- (i) The mother has blue eyes and the father has brown eyes. **Show with the aid of Punnett squares**, the possible gene pairs of their children. [4]

- (ii) There are two children in the family. One of the children has brown eyes and the other has blue eyes. State the gene pair for eye colour of the father.

.....

[1]

10. The chemical industry produces hydrogen chloride in large quantities. The chlorine used in this process is obtained from sodium chloride. Sodium chloride is obtained from the raw material rock salt.

(a) **Describe** the method of obtaining sodium chloride from rock salt. [4]

.....

.....

.....

.....

.....

(b) (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]



(c) Hydrogen gas (H_2) is combined with chlorine gas (Cl_2) to make hydrogen chloride (HCl). The equation for the reaction is shown below:



The quantity of a substance can be measured in **moles**. In this reaction, **one mole** of hydrogen combines with **one mole** of chlorine to produce **two moles** of hydrogen chloride. The table shows information about bond energies.

Bond	Bond energy in kJ per mole
H-H	436
Cl-Cl	242
H-Cl	431

- (i) Calculate the energy needed to break the bonds in one mole of hydrogen and one mole of chlorine. [2]

Energy required = kJ

- (ii) Calculate the energy given out when one mole of hydrogen chloride is formed. [2]

Energy given out = kJ

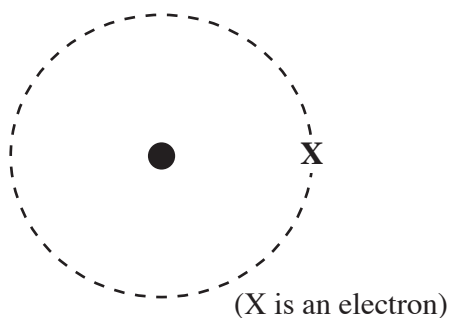
- (iii) Calculate the overall energy transfer in this reaction. [1]

Energy transfer = kJ

- (iv) State the name of this type of chemical reaction. [1]

.....

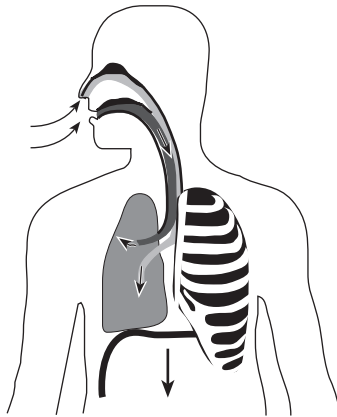
- (d) Hydrogen has an atomic number of 1. It has an electronic structure as shown below.



Chlorine has an atomic number of 17. Draw a similar diagram below to show the electronic structure of chlorine. [3]

11. (a) (i) Explain how the structures in the chest help us to breathe in.

[3]



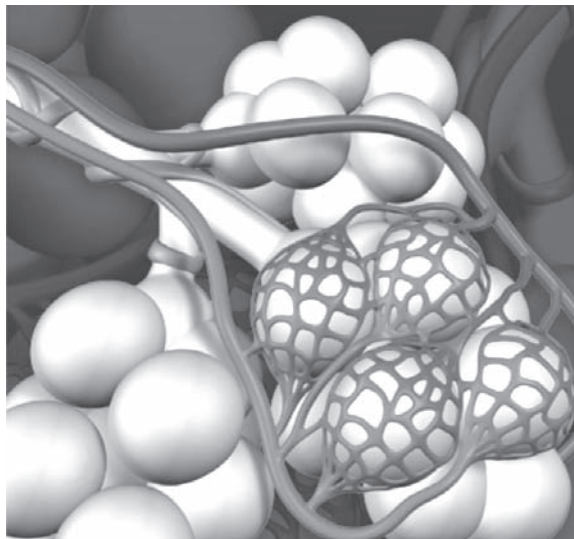
.....

.....

.....

.....

(ii) The air we breathe in enters air sacs in the lungs. These are surrounded by a network of blood vessels as shown in the diagram below.



Name and explain the process of gas exchange that occurs here.

[3]

.....

.....

.....

.....

(b) This exchange of gases in the air sacs is necessary to allow aerobic respiration to occur.

(i) **Name** the parts of the body where aerobic respiration occurs. [1]

.....

(ii) **State** the purpose of aerobic respiration. [1]

.....

(iii) **Name** the reactants required for aerobic respiration to occur. [2]

..... and

(iv) **Name** the chemical products of aerobic respiration. [2]

..... and

(v) Sometimes the respiration will become anaerobic. **Explain** why this may happen and **state** the name of the new product. [2]

.....

.....

.....