

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
APPLIED SCIENCE: DOUBLE AWARD**

**J649
B482/02**

Unit 2: Science for the needs of society
(Higher Tier)

**Friday 12 June 2009
Morning**

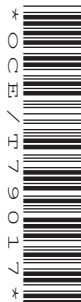
Duration: 1 hour

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:

- Pencil
- Ruler (cm/mm)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.
- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	10	
2	10	
3	10	
4	12	
5	10	
6	8	
TOTAL	60	

Answer **all** the questions.

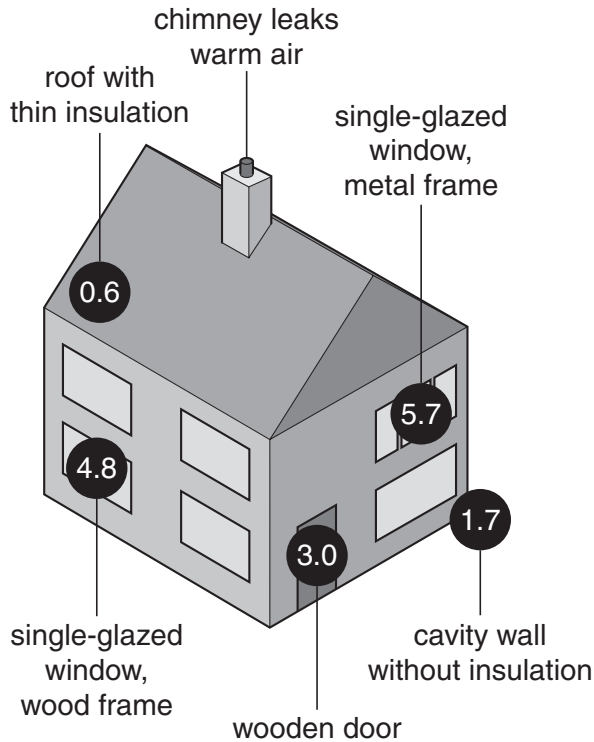
1 Simple home improvements can save a lot of energy.

Look at the diagram comparing energy loss in two types of house.

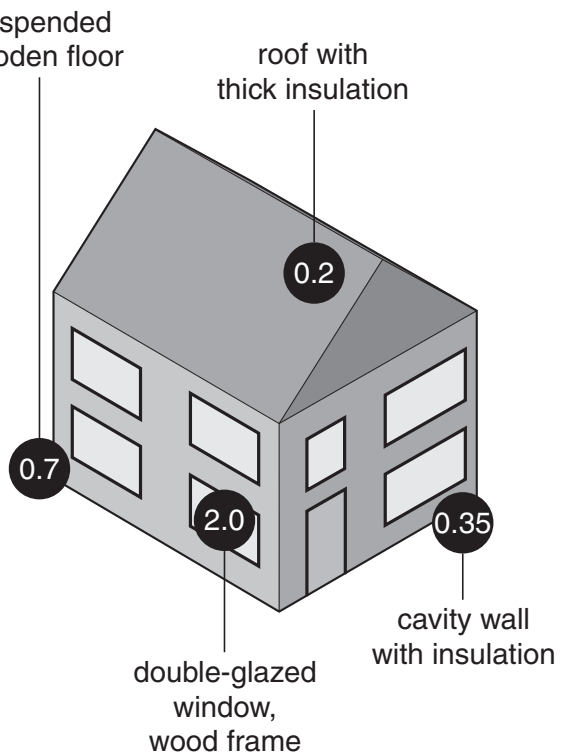
The bigger the U-value the more heat is lost.

KEEPING THE HEAT IN

bad house



good house



Key: ● = U-value (rate of heat loss)

(a) Use the information on the diagram to answer the following questions.

(i) How much does the use of cavity wall insulation **change** the U-value?

answer [1]

(ii) Wood and metal framed windows are used.

Which is the better insulator?

Explain how you worked out your answer.

.....

.....

..... [2]

(iii) The U-value for the roof is less in the 'good house'.

Suggest two changes that reduce the heat loss compared to the 'bad house'.

1

2 [2]

(b) A double-glazed window has a U-value of 2 watts per square metre per degree Celsius.

This means a one metre square window which is 1 °C warmer on the inside will lose 2 watts.

(i) How many watts would a 4 square metre window lose per degree Celsius?

answer watts per degree Celsius [1]

(ii) How many watts would a one square metre window lose if the temperature was 5 °C warmer inside the house?

answer watts [1]

(c) One major source of heat loss is air leakage.

Warm air escapes from the top of the house and cool air is drawn in lower down.

Which type of energy transfer process is involved in heat loss by air leakage?

Put a (ring) around the correct answer.

combustion conduction convection radiation

[1]

(d) The parts of the house that lose the most heat can be found using thermal imaging cameras.

The camera shows the different temperatures of each part of the house.

(i) Which part of the 'bad house' would show the highest temperature?

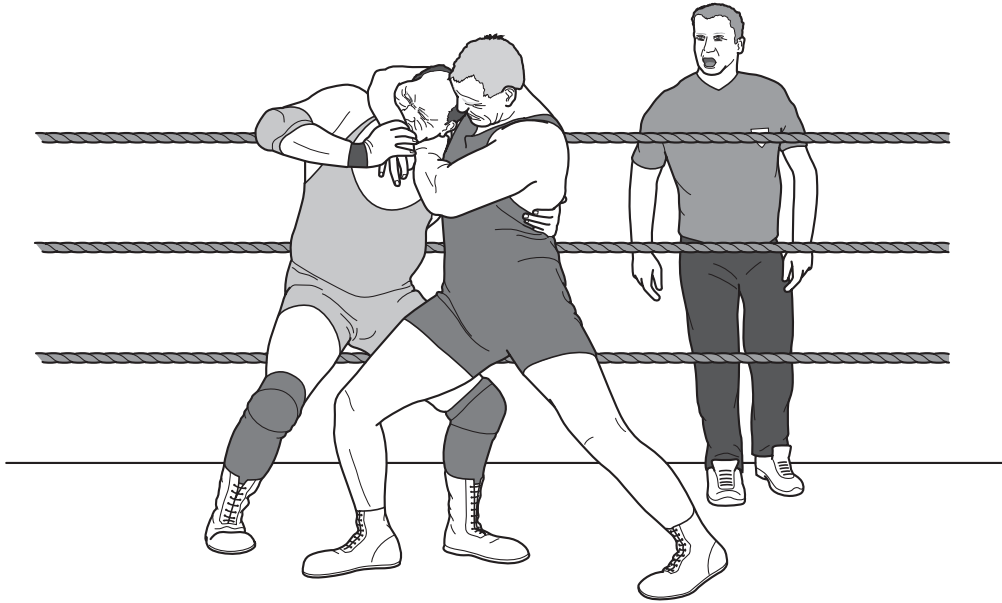
..... [1]

(ii) Which type of electromagnetic wave is used by thermal imaging cameras?

..... [1]

[Total: 10]

2 Recent research has shown that some diseases can be easily passed between wrestlers during a wrestling match.



(a) (i) Explain how a healthy wrestler may become infected with harmful microorganisms during a wrestling match.

.....
.....
..... [2]

(ii) Referees stand near to the wrestlers.

Referees are far less likely than wrestlers to catch diseases during a wrestling match.

Suggest why.

.....
..... [1]

(b) Viruses are one type of microorganism that can cause disease.

Which disease in humans is caused by a virus.

Put a ring around the correct answer.

- athlete's foot measles ringworm tuberculosis**

[1]

(c) Scientists have suggested two ways of stopping the spread of viruses.

(i) The scientists advise all wrestlers to get a vaccination.

Explain how a vaccination works.

Your answer should include:

- what is in a vaccine
- how it gets into the body
- what happens in the body.

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

[3]

(ii) The scientists have also suggested testing all wrestlers for infectious diseases before they fight.

How will this stop the spread of disease?

.....
.....

[1]

(d) Some virus infections can damage the heart.

A wrestler with a damaged heart does not fight as well.

Which of the following will result from a damaged heart?

Put a tick (✓) in the boxes next to the **two** correct answers.

oxygen and glucose will be moved around the body too quickly

waste products build up in cells

lung capacity is reduced

less oxygen will be in the blood

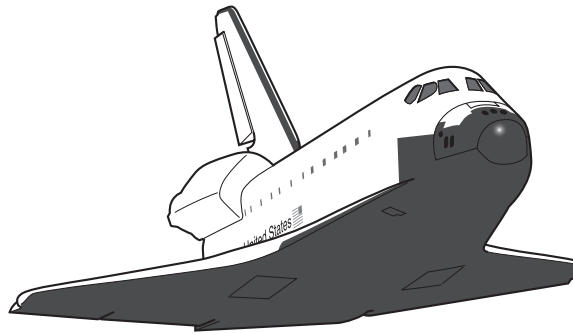
[2]

[Total: 10]

3 The outside skin of a space shuttle is made of different materials.

The skin needs to be able to withstand very high temperatures when it descends through the atmosphere.

The skin of the shuttle is made from aluminium alloy covered with ceramic tiles. The tiles are made by firing a silicon compound in a microwave oven.



(a) Aluminium alloy is much stronger than pure aluminium.

(i) What is an alloy?

..... [1]

(ii) Explain why the structure of aluminium alloy makes it stronger than pure aluminium.

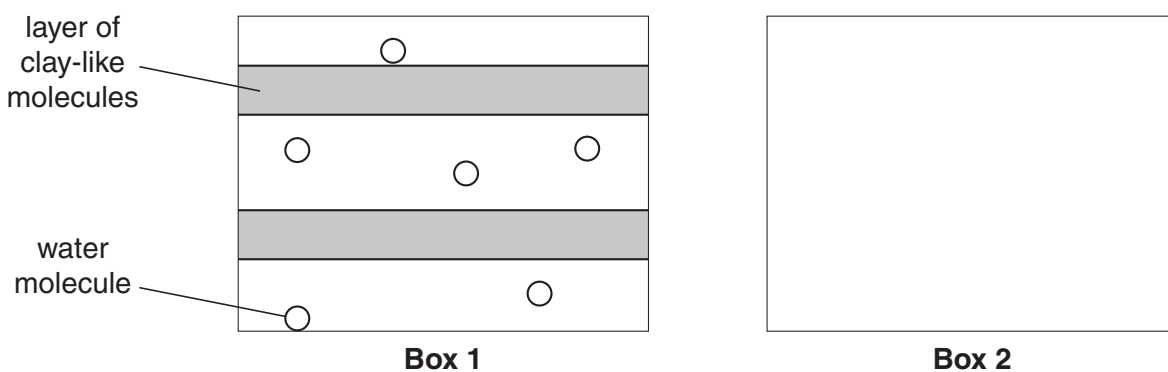
.....
 [2]

(b) The tiles are made by firing a silicon compound in a hot oven.

The silicon compound contains layers of molecules that have a structure similar to clay.

During firing, bonds form between the layers.

The diagram in Box 1 shows the structure of the silicon compound **before** firing.

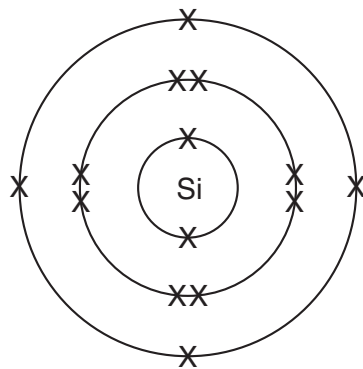


- (i) Draw a diagram in Box 2 to show the structure of the silicon compound **after** firing. [2]
- (ii) Explain why the fired tiles are suitable to be used on the space shuttle. Use ideas about structure in your answer.

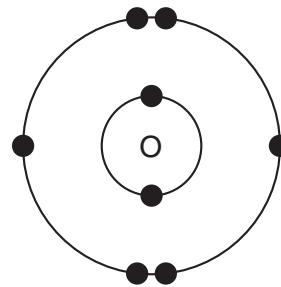
.....
 [2]

- (c) The two main elements in the tiles are silicon and oxygen.

The diagram shows the electron arrangement in a silicon atom and an oxygen atom.



silicon atom



oxygen atom

- (i) What type of bonds would you expect silicon to form?

..... [1]

- (ii) Describe this type of bond.

..... [1]

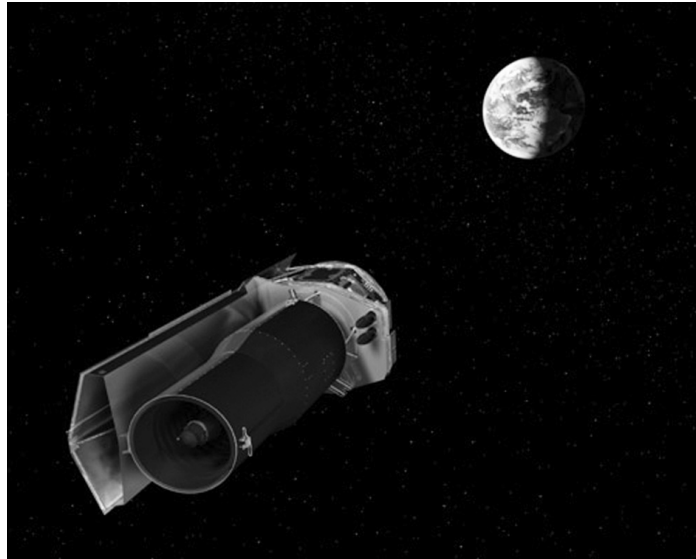
- (iii) How many **protons** are in an oxygen atom?

..... [1]

[Total: 10]

4 Astronomers use space telescopes to study the Universe.

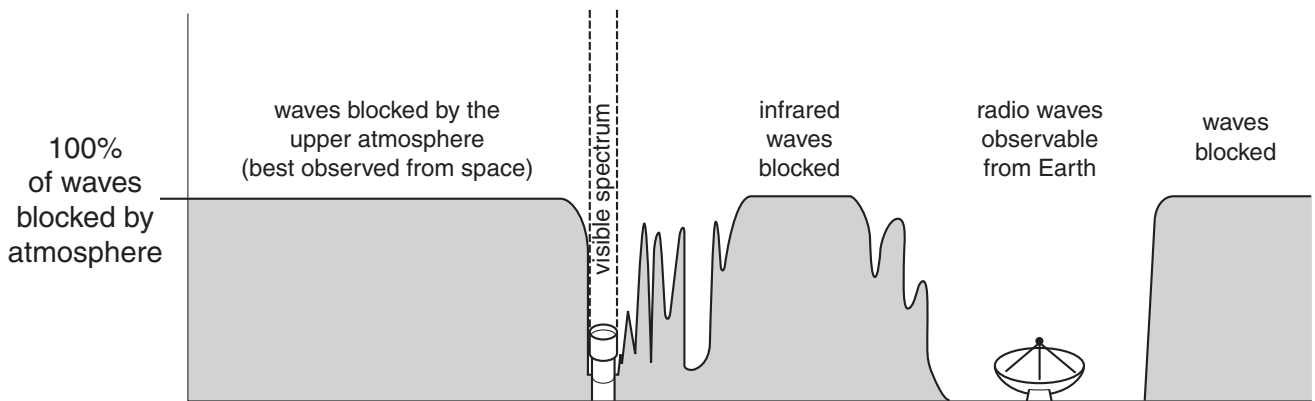
This is a picture of the Spitzer infrared space telescope.



The advantage of a space telescope is that it is above the Earth's atmosphere.

The gases in the Earth's atmosphere absorb some parts of the electromagnetic spectrum.

The diagram shows how the atmosphere absorbs parts of the electromagnetic spectrum.



electromagnetic spectrum

(a) Name two gases which are transparent to radio waves.

Use information from the diagram to help you.

..... and [2]

(b) Draw two arrows on the diagram, to show:

- the direction of increasing **wavelength**
- the direction of increasing **frequency**.

You must label the arrows clearly. [2]

(c) Name two different regions of the electromagnetic spectrum, other than infrared, that are mostly absorbed by the Earth's atmosphere.

..... and [2]

(d) The atmosphere absorbs most of the infrared light waves.

The Spitzer telescope can detect infrared light waves with a wavelength of 0.001 m and a frequency of 3×10^{11} Hz.

(i) Write the formula relating wave speed, wavelength and frequency.

..... [1]

(ii) Calculate the speed of infrared light waves.

speed = m/s [2]

(e) Space telescopes have given us much information about stars, galaxies and distances in space.

Complete the following sentences using numbers from the list.

- 0.001 4 1000 300 billion**

The nearest star, other than the Sun, is about light years away.

The solar system is about light years across.

Our galaxy is made up of about stars.

[3]

[Total: 12]

5 Cystic fibrosis is a genetic disorder.

Cells produce mucus that is too thick.

This causes problems with breathing and digestion.

People can be carriers of cystic fibrosis without having the disorder.

(a) (i) Explain what is meant by a genetic disorder.

.....
..... [2]

(ii) Use words from the list to complete the description of a carrier of cystic fibrosis.

dominant

genetic

heterozygous

homozygous

recessive

A carrier of cystic fibrosis must have both a cystic fibrosis allele
and a normal allele.

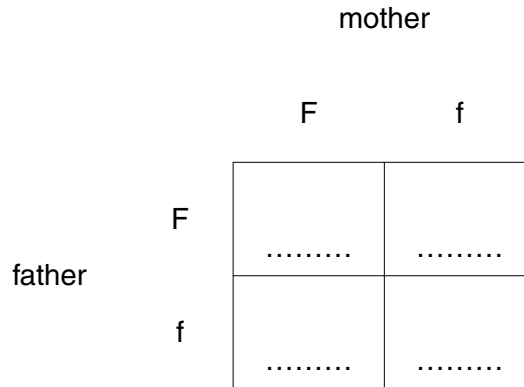
This means that they are for the cystic fibrosis gene.

[3]

(b) This diagram shows how the alleles from a mother and father can combine.

Each letter represents an allele.

(i) Complete the diagram by filling in the boxes.



[1]

(ii) On the diagram put a ring around an allele that represents a gamete.

[1]

(iii) What is the name of the type of cell division that produces gametes?

..... [1]

(iv) Write down the combination of alleles of a child who has cystic fibrosis.

..... [1]

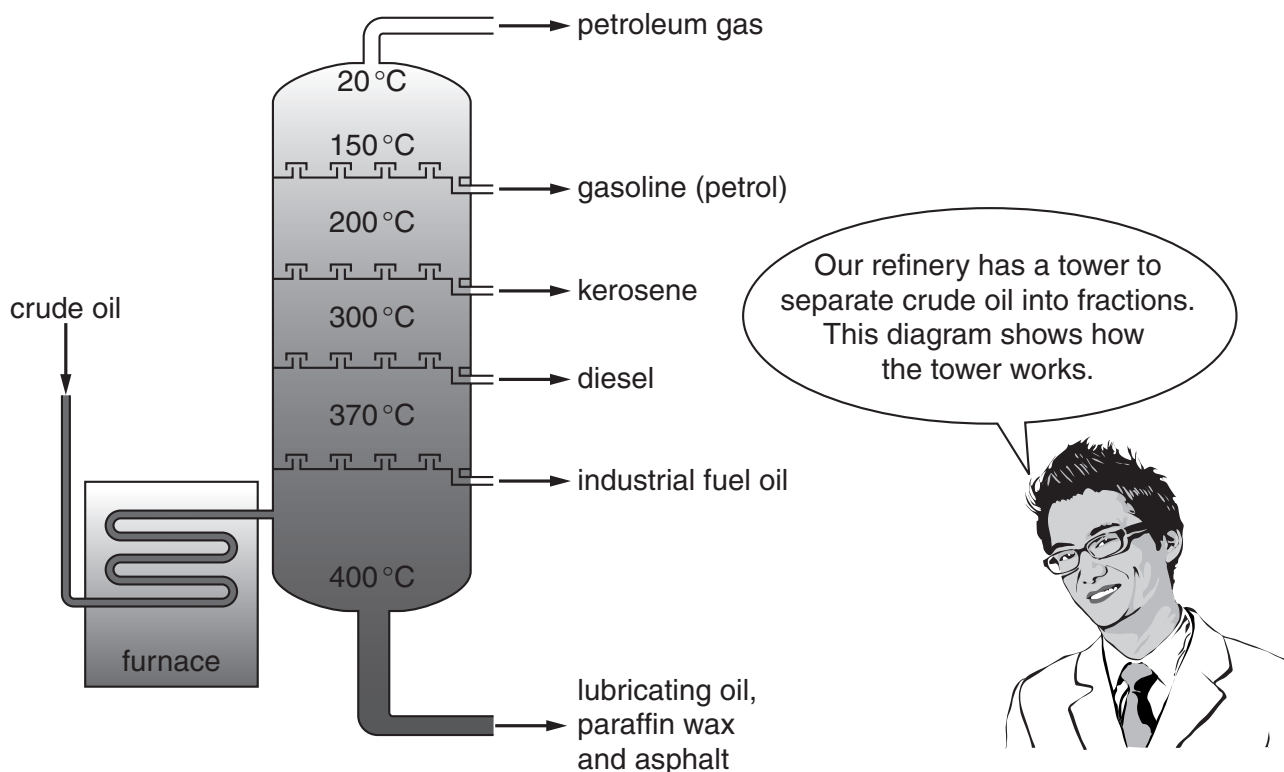
(v) What is the probability of a child of this mother and father having cystic fibrosis?

..... [1]

[Total: 10]

6 Joe visits an oil refinery.

The guide tells him how crude oil is separated into fractions.



(a) What is the name for this industrial process?

..... [1]

(b) Which of the following statements explain how the process works?

Put ticks (✓) in the boxes next to the **two** correct statements.

the fractions solidify as they rise up the tower

the compounds in crude oil have different boiling points

the fractions condense at different temperatures

the higher up the tower the higher the temperature

the fractions are filtered in the tower

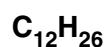
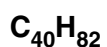
[2]

(c) The table shows some information about four compounds from crude oil.

formula of compound	found in fraction
C_8H_{18}	petrol
$C_{40}H_{82}$	lubricating oil
$C_{12}H_{26}$	diesel
C_3H_8	petroleum gas

(i) Which of the compounds in the table is likely to have the highest boiling point?

Put a (ring) around the correct answer.



[1]

(ii) Explain your choice.

Use ideas about **intermolecular forces**.

.....

.....

..... [2]

(iii) Which word applies to all four compounds?

Put a (ring) around the correct answer.

acidic

alkaline

composite

inorganic

organic

[1]

(iv) Explain your reasoning.

.....

..... [1]

[Total: 8]

END OF QUESTION PAPER

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