

Candidate forename						Candidate surname					
Centre number						Candidate number					

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A216/02

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 2: Modules B5 C5 P5 (Higher Tier)

MONDAY 25 JUNE 2012: Afternoon

DURATION: 40 minutes
plus your additional time allowance

MODIFIED ENLARGED

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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

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 42.**
- **A list of physics equations is printed on pages 4 and 5.**
- **An enlarged copy of the Periodic Table will be provided.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer ALL the questions.

1 Read this article.

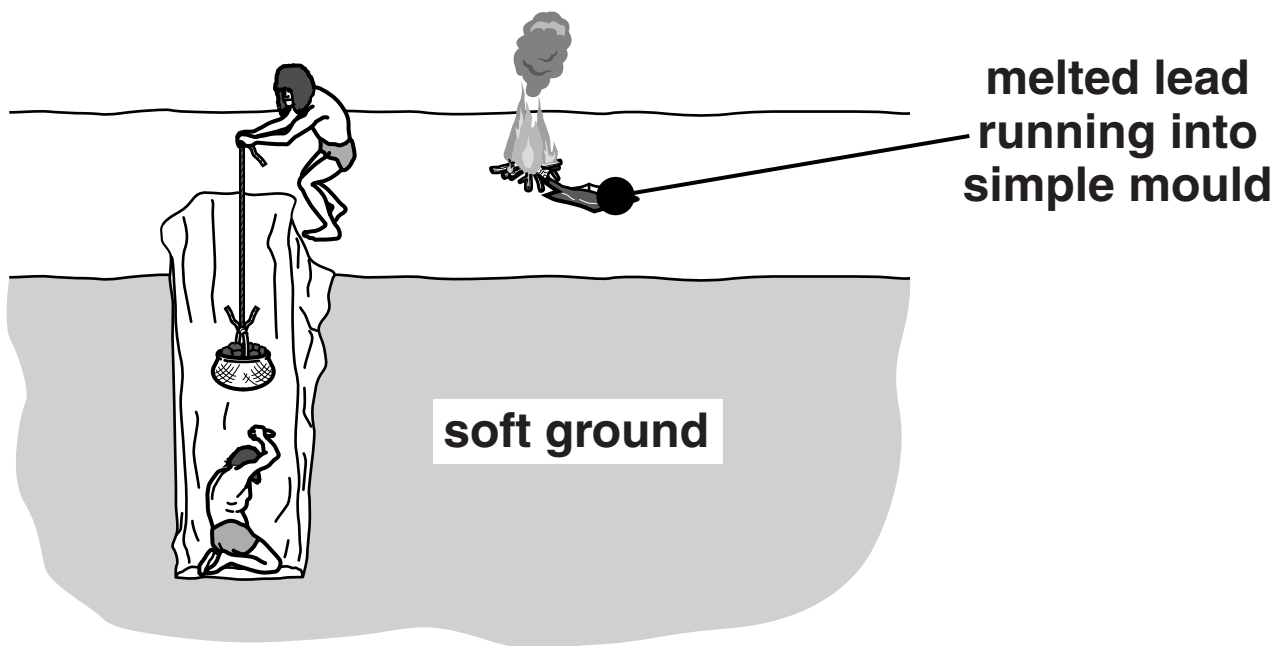
Archaeologists have discovered a small lead mine that was used 4000 years ago.

The miners made a deep hole through soft ground until they reached the lead ore.

They then dug out the ore and loaded it into baskets.

A second group of men lifted the ore out of the mine and put it into a wood fire. The carbon in the wood reacted with the ore to make sulfur dioxide, carbon dioxide, and molten lead.

The molten lead was run into moulds and allowed to solidify.



Here is some information about three of the substances involved in the process.

	lead	lead ore	sulfur dioxide
hazard	prolonged exposure to dust or fumes is harmful	prolonged exposure to dust or fumes is harmful	acidic gas

(a) Use information in the article and table above to suggest two risks of the process.

Include in your answer

- how each risk is created**
- who would be at risk.**

[3]

- (b) The lead ore contains lead sulfide. Two reactions take place when lead sulfide is heated in the fire.**
- (i) In the first reaction in the fire, oxygen gas reacts with solid lead sulfide to make solid lead oxide and sulfur dioxide gas.**

Complete the table to show the state symbols for the substances in this reaction.

One has been done for you.

substance	state symbol
oxygen	g
lead sulfide	
lead oxide	
sulfur dioxide	

[1]

- (ii) In the second reaction, carbon takes oxygen away from the lead oxide to make lead and another substance.**

Suggest a word equation for this reaction.

_____ **[1]**

(iii) Carbon takes oxygen away from lead oxide.

What does this tell you about lead?

Put a tick (✓) in the box next to the correct answer.

It is a silvery metal.

☐

It is not very reactive.

☐

It is a pollutant.

☐

It is a dense metal.

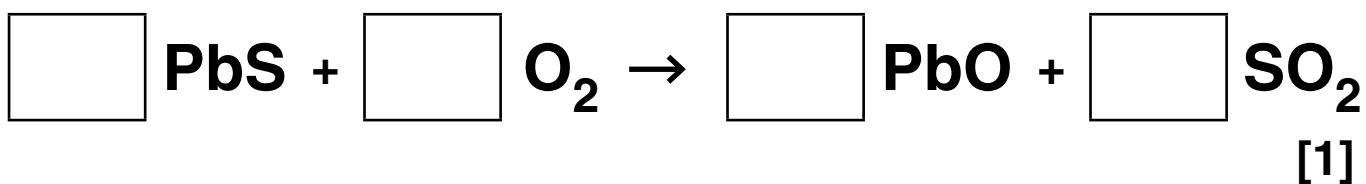
☐

[1]

(iv) What do we call a reaction in which oxygen is removed?

_____ **[1]**

(v) Put numbers in the boxes to balance the equation for this reaction.



(c) Many lead ores contain a high percentage of lead.

Calculate the percentage mass of **Pb** in **PbS**.

(relative atomic masses : sulfur = **32**, lead = **207**)

answer = _____ % [1]

[Total: 9]

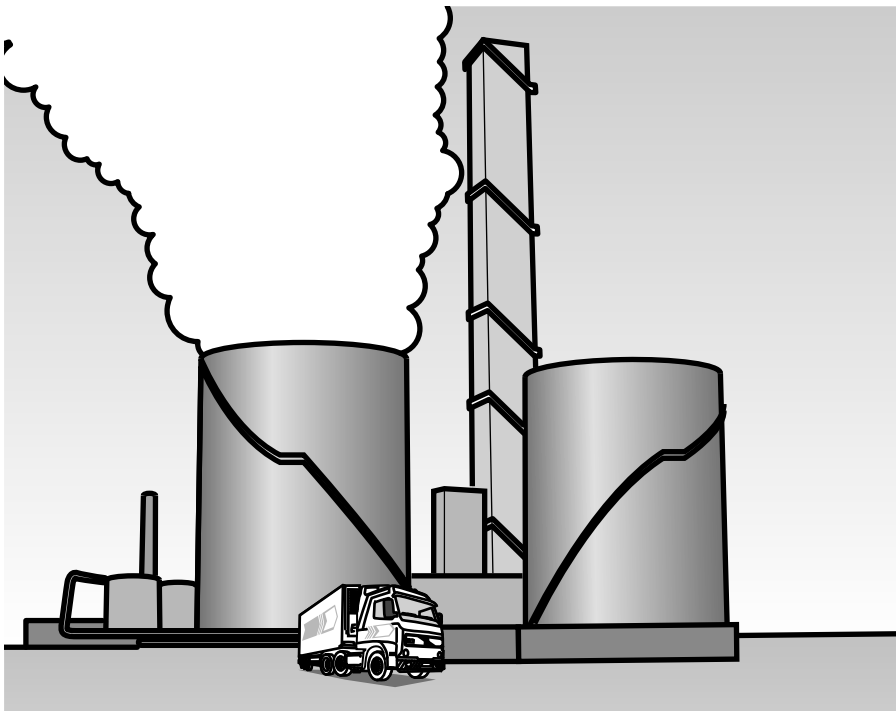
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2 British industry uses thousands of tonnes of oxygen and nitrogen every year.

We take these gases out of the air.

The air is cooled to a very low temperature until it turns into a liquid.

Oxygen and nitrogen can then be separated by warming the liquid.



The gases can be separated because they have different boiling points.

Nitrogen has a lower boiling point than oxygen.

Explain why nitrogen has the lower boiling point.

[3]

[Total: 3]

3 Magnesium chloride can be extracted from seawater.

Magnesium chloride is an ionic solid.

What happens when it dissolves in water?

Draw ONE line from the correct START to the correct DESCRIPTION OF THE SOLUTION.

START

**Ions are already
present before the
solid dissolves.**

OR

**Ions only form
once the solid has
dissolved.**

OR

**Ions only form once a
current is turned on.**

**DESCRIPTION OF
THE SOLUTION**

**Ions of opposite
charge come
together in the liquid.**

OR

**Ions are spread
through the liquid.**

OR

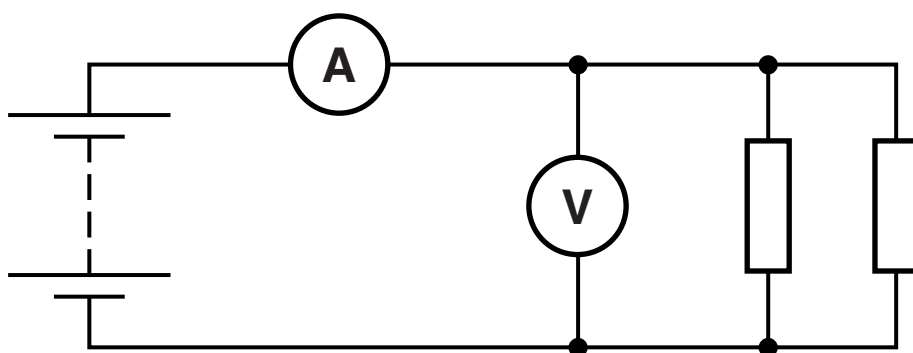
**Ions sink to the
bottom of the liquid.**

[2]

[Total: 2]

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- 4 Alyson uses this circuit to investigate the current drawn from a battery by resistors in parallel.



The diagram shows Alyson's circuit when she has **TWO** identical resistors in parallel.

She changes the number of identical resistors in parallel and obtains these results.

number of resistors	current in amps	p.d. in volts
none	0.00	2.8
one	0.07	2.8
two	0.14	2.8
three	0.21	2.8

- (a) Calculate the resistance of just **ONE** of the resistors.

resistance = _____ Ω [1]

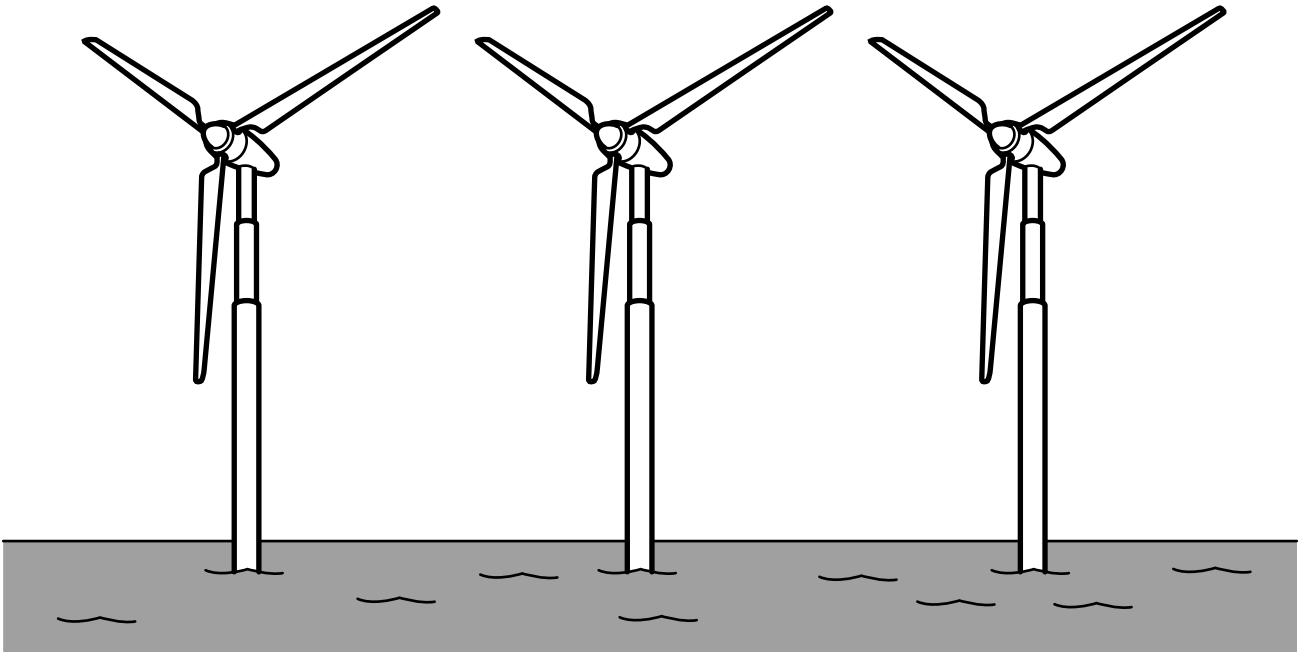
(b) Alyson notices that increasing the number of resistors increases the current.

Use ideas about parallel circuits to explain the pattern in Alyson's results.

[3]

[Total: 4]

- 5 At least **10%** of mains electricity in the UK comes from wind turbines out at sea.



(a) The turbines generate a.c. electricity.

Here are some possible reasons why.

Put ticks (✓) in the boxes next to the **TWO** correct reasons.

a.c. is much safer than d.c.

☐

d.c. can only come from batteries.

☐

a.c. is easier to generate than d.c.

☐

a.c. can be at a much higher power than d.c.

☐

a.c. can be distributed more efficiently than d.c.

☐

[2]

(b) The generator in each turbine contains a magnet which spins near a coil of wire.

(i) Here are some ways to increase the voltage from a generator.

Complete the sentences by putting a ring around the correct words in CAPITALS.

**Put some ALUMINIUM / COPPER / IRON
inside the coil.**

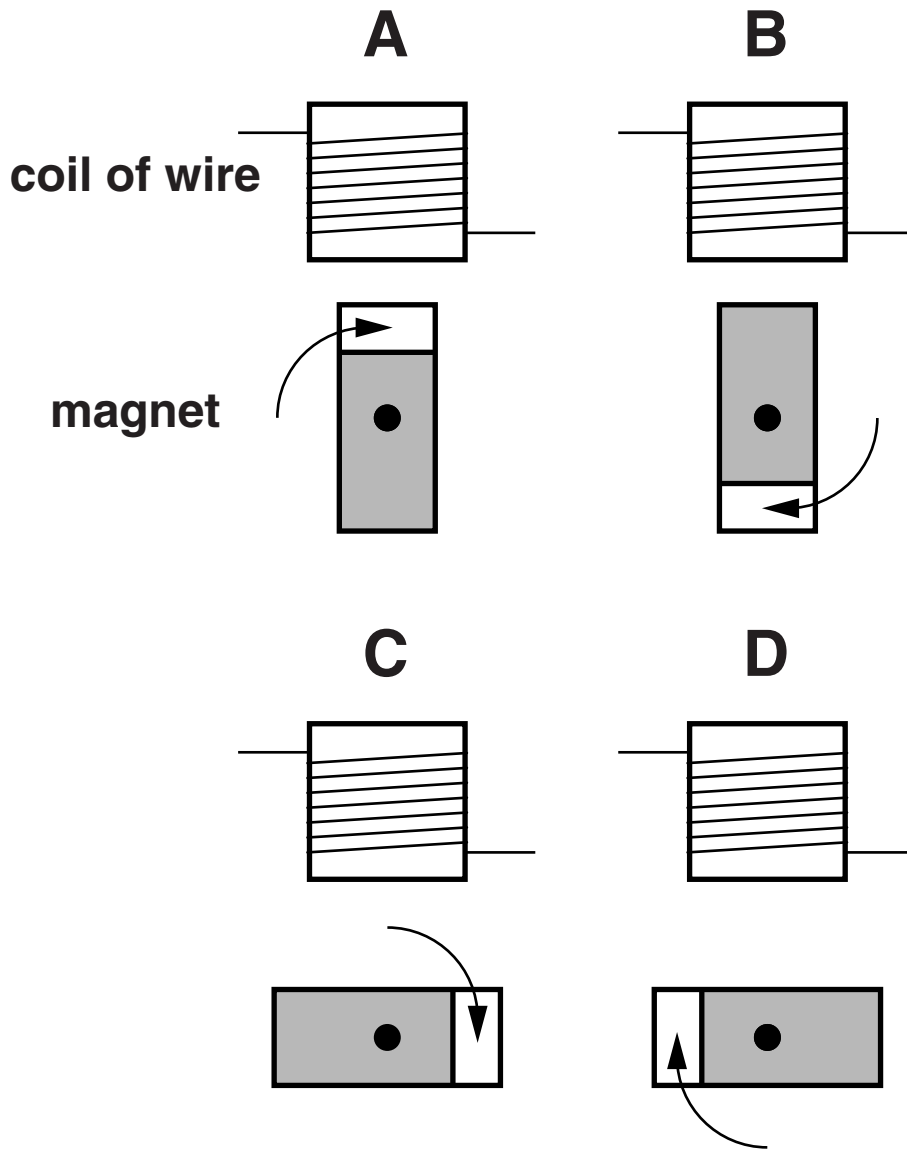
Make the magnet spin FASTER / SLOWER.

**Replace the coil with one that has
FEWER / MORE turns of wire.**

[1]

(ii) The magnet rotates **CLOCKWISE**.

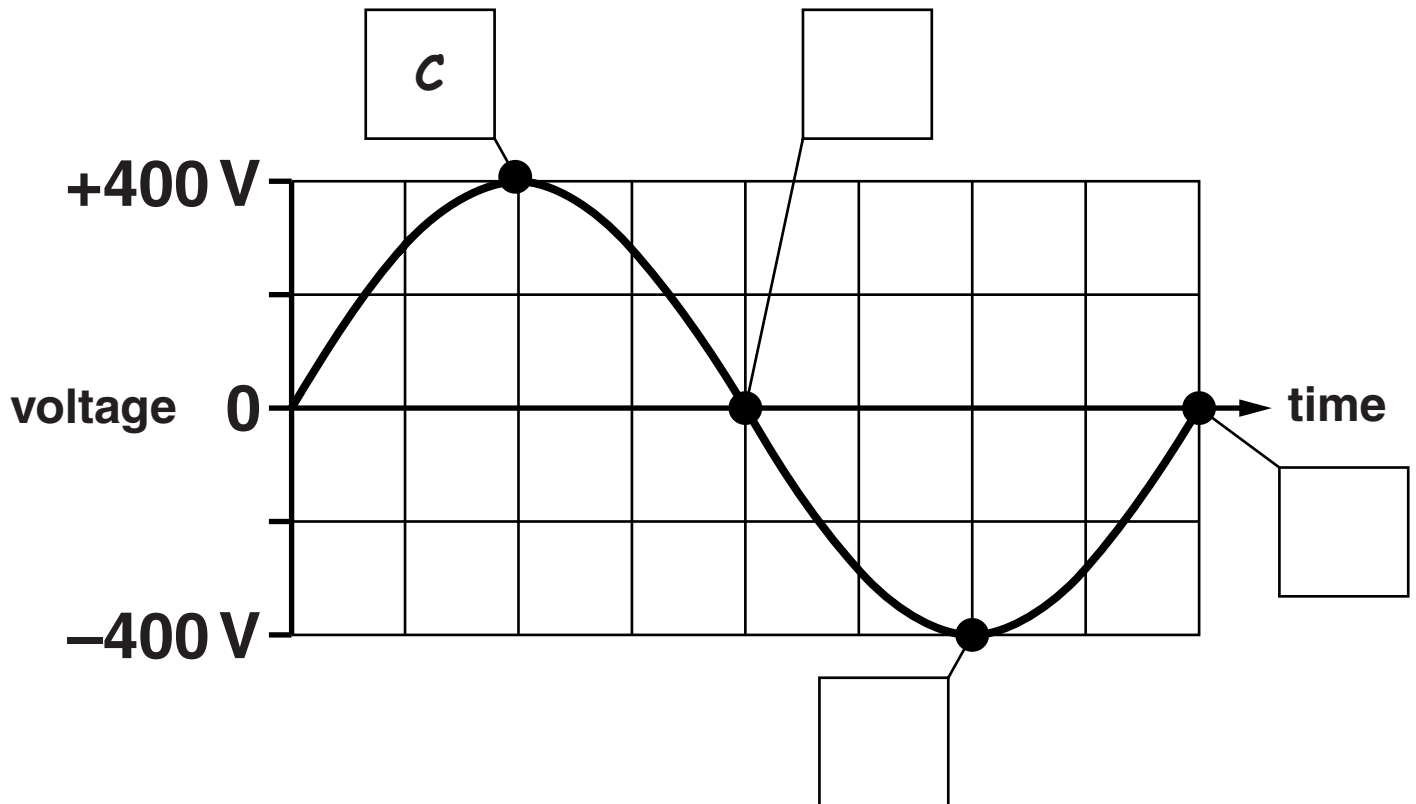
Here are four positions (**A**, **B**, **C** and **D**) the magnet can take.



The graph shows how the voltage across the coil changes as the magnet rotates.

Complete the boxes to show the position of the magnet at that time.

One box has been completed for you.



[1]

- (c) Here are some data for the output of a generator in a wind turbine.

frequency	50 Hz
potential difference	1200V
output power	2400 kW

What is the current in the coil of the generator?

Put a ring around the correct answer.

0.02 A

0.5 A

2 A

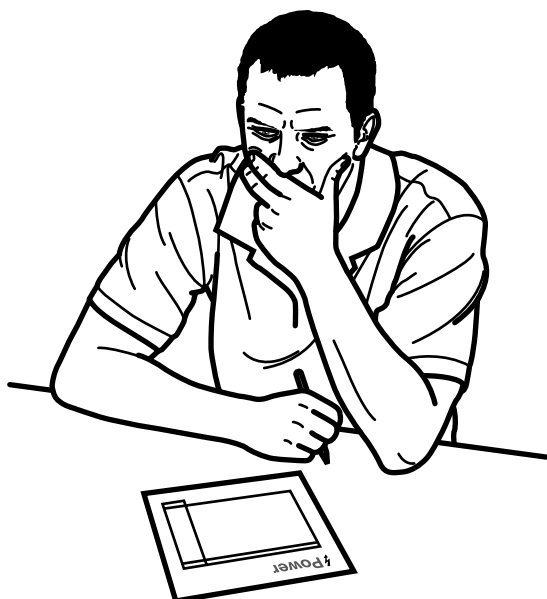
2000 A

[1]

[Total: 5]

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6 Bill worries about how much he pays for electricity.



He investigates the energy used by the appliances in his home.

(a) The table shows the electricity he uses at home in a typical week.

appliance	power in kW	hours of use
power shower	5.0	2
fan heater	1.5	20
computer	0.5	30
lights	1.0	15

- (i) Which appliance uses the most electricity in a week?

answer _____ [1]

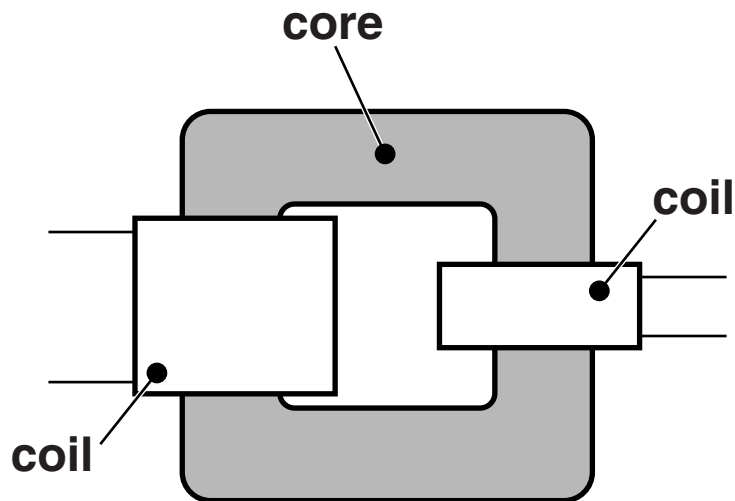
- (ii) Bill pays **12p** for each kilowatt hour of electricity.

Calculate how much he pays for electricity in a typical week.

cost = _____ p [1]

- (b) Bill's computer is connected to the mains electricity supply by a transformer.

The transformer contains two coils of wire wound around a core.



- (i) Write down the best material to use for the core.

answer _____ [1]

- (ii) The transformer reduces the **230V** a.c. mains supply to **9.2V** a.c.

The primary coil contains **10 000** turns of wire.

How many turns of wire does the secondary coil have?

Put a **ring** around the correct answer.

25

400

92 000

250 000

[1]

- (iii) The transformer has an efficiency of **98%** when its input power is **500W**.

Calculate the energy that the transformer wastes as heat in one second.

waste energy in one second = _____ J [1]

[Total: 5]

7 This question is about DNA and cell division.

(a) Look at the statements about DNA and proteins.

Put a tick (✓) in the box next to the correct statement.

DNA is cut up into lengths of protein.

☐

A copy of the DNA is carried to where proteins are made.

☐

Parts of the protein are made next to the DNA then taken away to be put together.

☐

DNA is changed into amino acids, which then move around the cell.

☐

[1]

(b) Put a tick (✓) in the box next to the correct word or phrase to complete each sentence.

The bases join together to hold one

chromosome	
DNA strand	
gene	

to another.

During mitosis

chromosomes	
DNA strands	
genes	

separate.

During the growth part of the cell cycle

chromosomes	
DNA strands	
genes	

separate.

[2]

(c) Mitosis produces new cells from a parent cell.

Put a tick (✓) in the box next to the correct statement.

Each parent cell produces four new cells.

☐

The new cells are genetically different from each other.

☐

The new cells are genetically identical to the parent cell.

☐

The parent cell has more genes than the new cells.

☐

[1]

(d) Mutations can occur in DNA.

Sometimes this results in an extra base being added to the base sequence in a gene.

Explain how the extra base could change the protein the gene codes for.

[3]

[Total: 7]

8 Ben is going camping in North America.

He hopes to see black bears.



(a) Despite their name, not all black bears have black fur.

The colour of the fur depends on the proteins produced in hair-growing cells.

Put a ring around the correct words to join the start of each sentence to its end.

The genes for the colour proteins are found ...

ONLY IN HAIR-GROWING CELLS

ONLY IN SECRETING CELLS

IN EVERY CELL

ONLY IN REPRODUCTIVE CELLS

... of the black bear.

Each cell in the bear has ...

NONE

ONE

MANY

ALL

... of its genes inactive.

[2]

(b) An adult black bear has **74** chromosomes in each body cell.

Put a tick (✓) in the box next to the correct word to complete each sentence.

The black bear produces gametes by

meiosis.	
mitosis.	
fertilisation.	
tropism.	

34 After fertilisation, each zygote will contain

37	
46	
74	
148	

chromosomes from each parent.

The zygote divides by

meiosis	
mitosis	
fertilisation	
tropism	

to form an embryo.

[Total: 4]

[2]

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- 9 A plant next to a window bends as the stem grows towards the light. Four friends comment on what is happening.

They try to explain what is happening.

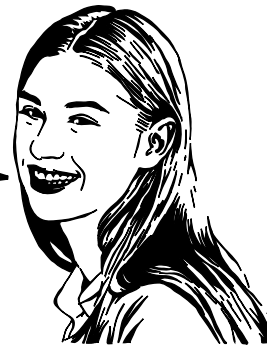
MICHAEL

This is called phototropism.



ADELE

This helps the plant to reach more oxygen so that it can grow faster.



ADAM

This helps the plant to make more sugars so it can grow faster.



TERESA

This is called specialisation because different tissues are being formed.



(a) Which two friends make correct statements?

answer _____ and

[1]

(b) Which TWO words can be used to describe the chemical that causes this growth towards the light?

Put rings around the TWO correct answers.

auxin

chlorophyll

enzyme

hormone

meristem

[1]

(c) Draw ONE line to join WHERE THE CHEMICAL COLLECTS with ITS EFFECT ON PLANT GROWTH.

**WHERE THE
CHEMICAL
COLLECTS**

**ITS EFFECT ON
PLANT GROWTH**

**at the tip of the
shoot**

**makes the tip grow
more**

**on both sides of the
shoot**

**makes the side in
the light shorten**

**on the shaded side
of the shoot**

**makes the shaded
side lengthen**

**on the side of the
shoot in the light**

**makes the side in
the light lengthen**

**makes the shaded
side shorten**

[1]

[Total: 3]

END OF QUESTION PAPER

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