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Monday 25 June 2012 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A216/02 Unit 2: Modules B5 C5 P5 (Higher Tier)

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)

Duration: 40 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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).
- Do **not** write in the bar codes.

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 page 2.
- The Periodic Table is printed on the back page.
- This document consists of **20** pages. Any blank pages are indicated.

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.

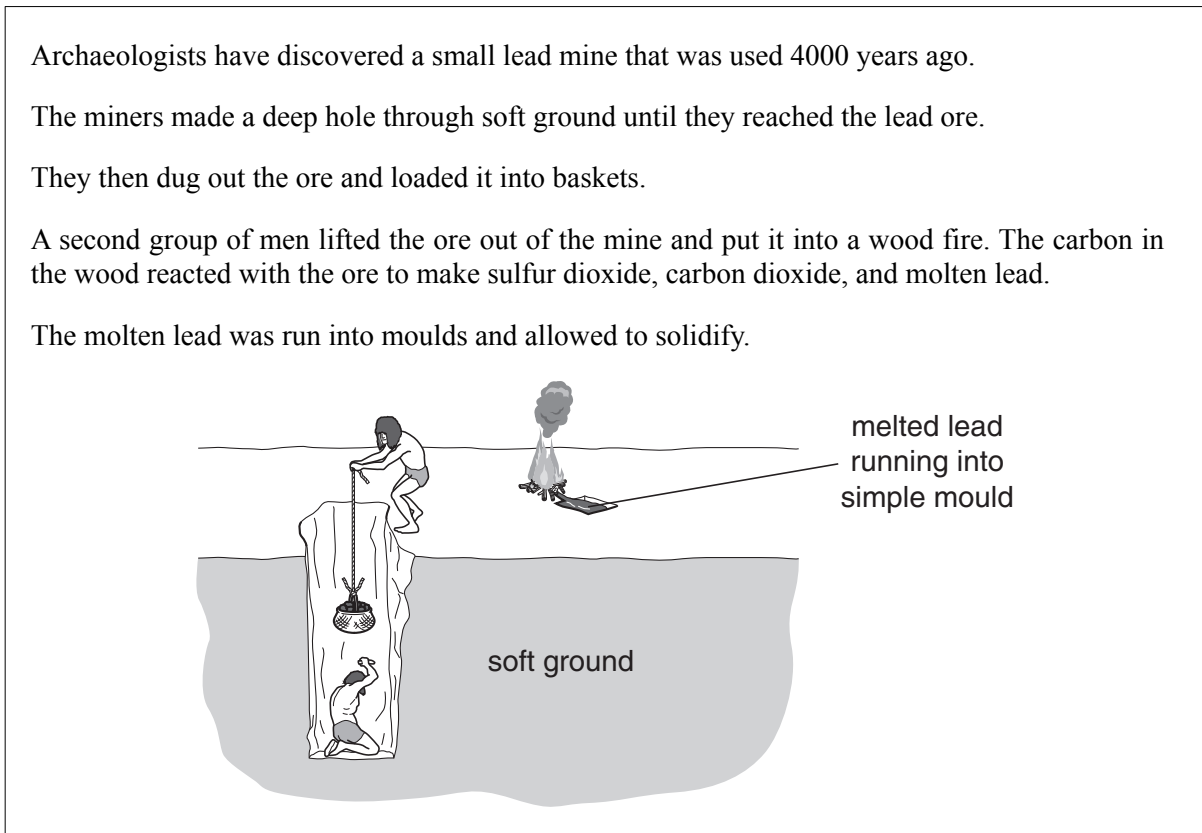
Archaeologists have discovered a small lead mine that was used 4000 years ago.

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.

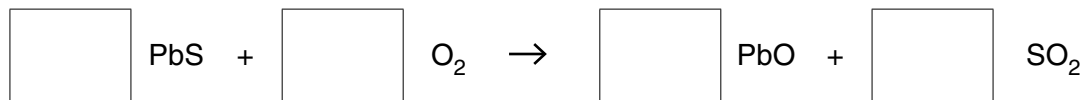
It is a dense metal.

[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.



[1]

(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]

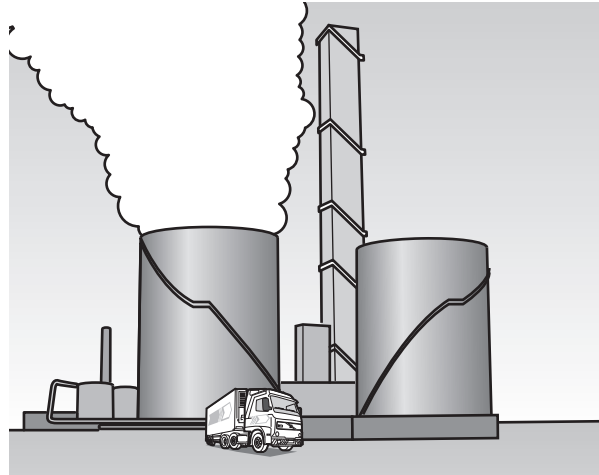
[Total: 9]

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.

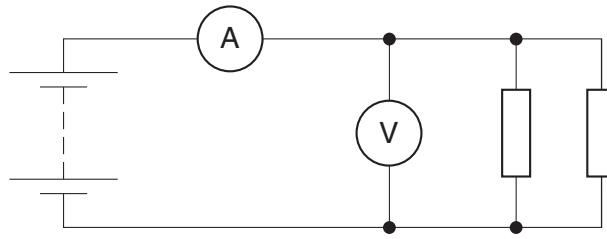
OR

Ions sink to the
bottom of the liquid.

[2]

[Total: 2]

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.

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.....

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.....

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.....

..... [3]

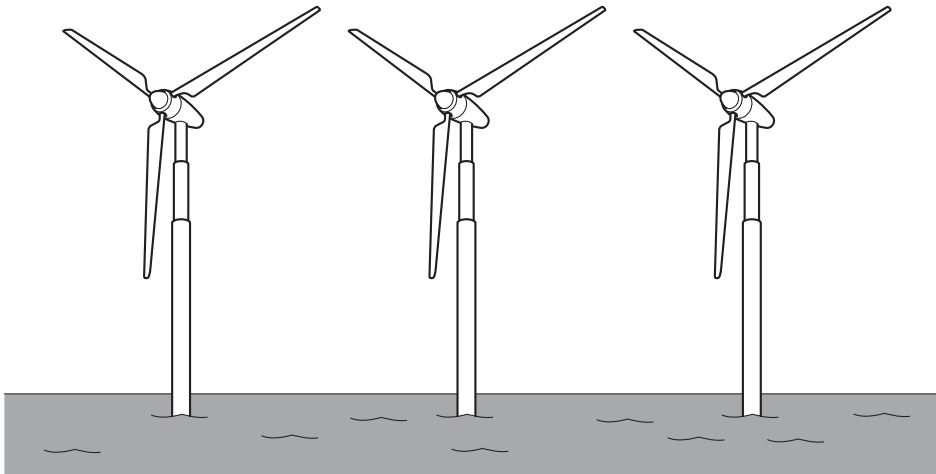
[Total: 4]

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Question 5 begins on page 10

PLEASE DO NOT WRITE ON THIS PAGE

- 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 **bold**.

Put some **aluminium** / **copper** / **iron** inside the coil.

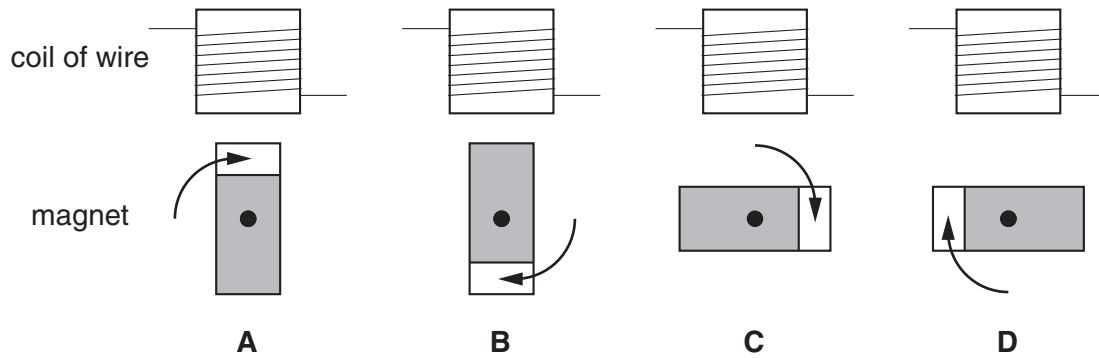
Make the magnet spin **faster** / **slower**.

Replace the coil with one that has **fewer** / **more** turns of wire.

[1]

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

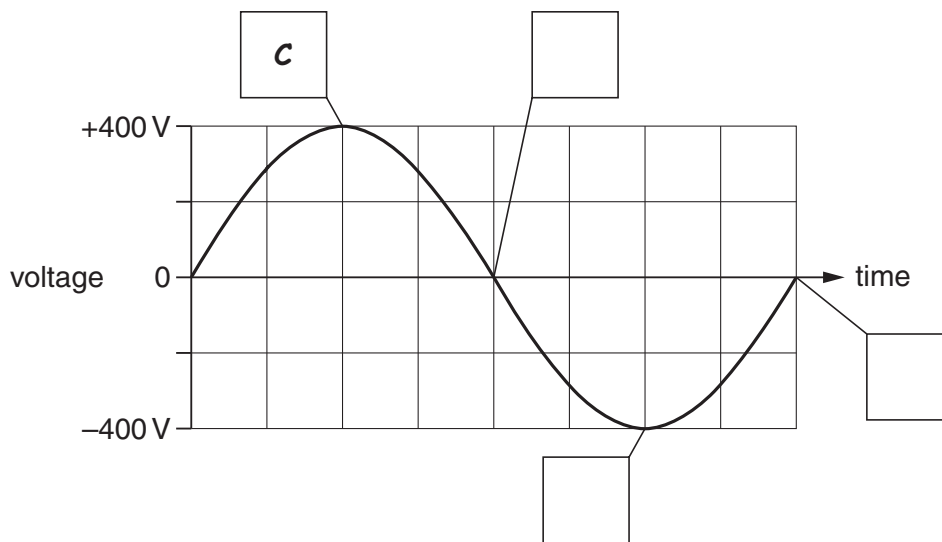
Here are four positions the magnet can take.



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	1200 V
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

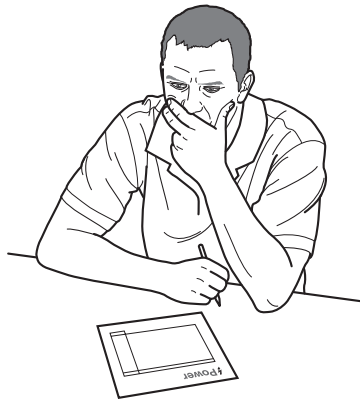
2000 A

[1]

[Total: 5]

Turn over

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]

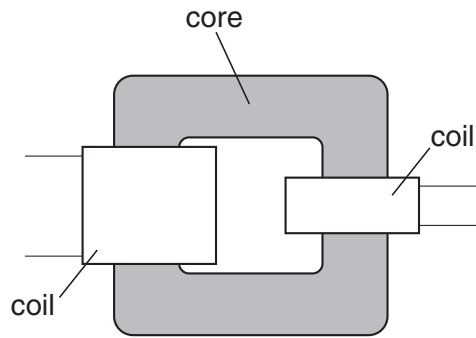
(ii) Bill pays 12p for each kilowatt hour of electricity.

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	<input type="checkbox"/>
DNA strand	<input type="checkbox"/>
gene	<input type="checkbox"/>

to another.

During mitosis

chromosomes	<input type="checkbox"/>
DNA strands	<input type="checkbox"/>
genes	<input type="checkbox"/>

separate.

During the growth part of the cell cycle

chromosomes	<input type="checkbox"/>
DNA strands	<input type="checkbox"/>
genes	<input type="checkbox"/>

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.

.....

.....

.....

.....

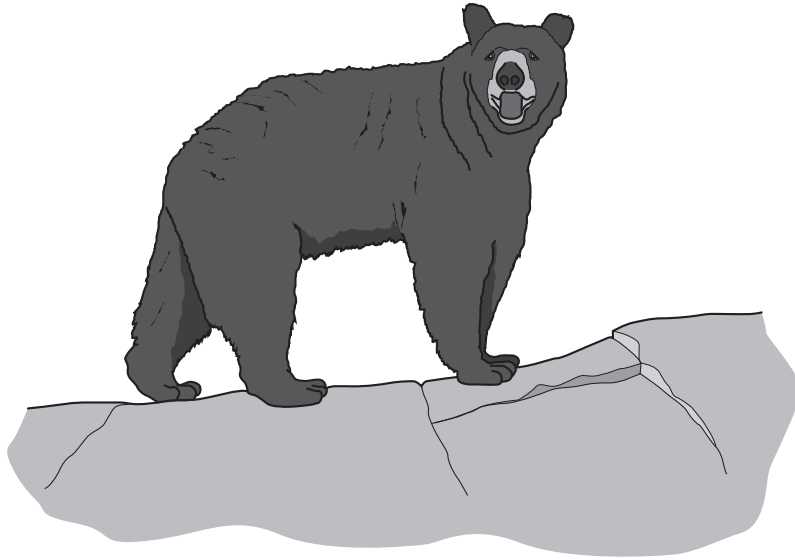
.....

..... [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.	<input type="checkbox"/>
	mitosis.	<input type="checkbox"/>
	fertilisation.	<input type="checkbox"/>
	tropism.	<input type="checkbox"/>

After fertilisation, each zygote will contain	37	<input type="checkbox"/>	chromosomes from each parent.
	46	<input type="checkbox"/>	
	74	<input type="checkbox"/>	
	148	<input type="checkbox"/>	

The zygote divides by	meiosis	<input type="checkbox"/>	to form an embryo.
	mitosis	<input type="checkbox"/>	
	fertilisation	<input type="checkbox"/>	
	tropism	<input type="checkbox"/>	

[2]

[Total: 4]

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.



(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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