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Monday 30 January 2012 – Afternoon

**GCSE GATEWAY SCIENCE
SCIENCE B**

B622/02 Unit 2 Modules B2 C2 P2 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

Duration: 1 hour

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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MODIFIED LANGUAGE

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.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{fuel energy input} = \text{waste energy output} + \text{electrical energy output}$$

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

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

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

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

BLANK PAGE

Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B2

- 1 Mosquitoes are insects that develop from larvae that live in water.



Sue is investigating how many mosquito larvae live in her local pond.

She puts a quadrat on the surface of the pond and counts the number of mosquito larvae inside the quadrat.

She does this in three different places on the pond's surface.

The table shows her results.

quadrat	number of mosquito larvae
1st	4
2nd	1
3rd	7

- (a) (i) The area of each quadrat is 0.25 m^2 .

The area of the pond is 8 m^2 .

Use this information and Sue's results to estimate the total number of mosquito larvae in the pond.

Show your working.

answer

[2]

- (ii) This might not be a very reliable estimate.

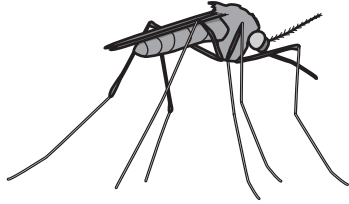
Write down **one** way Sue could improve her results to give a more reliable estimate.

.....
 [1]

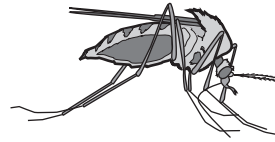
(b) The larvae develop into adult mosquitoes.

Look at the pictures.

They show two types of mosquito that live near the pond.



type A



type B

Sue thinks the two types might be the same species because they look very similar.

(i) Describe how Sue could show whether the two types are the same species.

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

(ii) If the two types are two **different** species, explain why they look so similar.

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

(c) Some mosquitoes have been found preserved in amber.

These are the actual bodies of the mosquitoes, not imprints like many fossils.

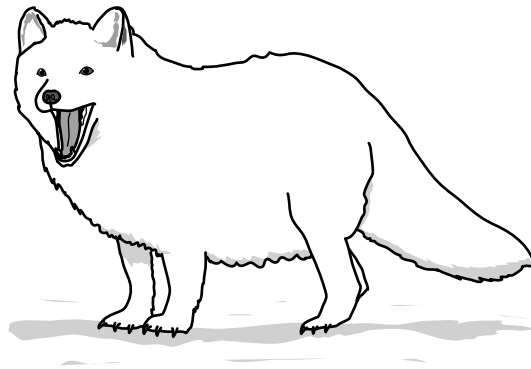
These mosquitoes are millions of years old.

Write down **one other** way that actual animal bodies can be naturally preserved for long periods of time.

..... [1]

[Total: 7]

2 The Arctic fox lives in the Arctic.



(a) The Arctic fox is adapted to living in cold Arctic conditions.

Look at the picture of the Arctic fox.

Explain **two** ways that the Arctic fox is adapted to living in the Arctic.

1

.....

2

..... [2]

(b) Arctic foxes eat lemmings.



In some years the number of lemmings decreases.

Suggest what effect this has on the number of Arctic foxes.

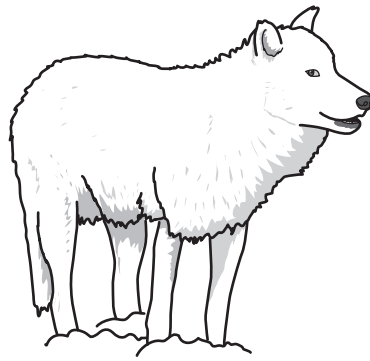
Explain why it has this effect.

effect

explanation

..... [2]

(c) Arctic wolves also live in the Arctic and eat lemmings.



Both Arctic wolves and Arctic foxes survive because, although they have **similar** ecological niches, their niches are **not** exactly the same.

Suggest **one** way their niches may be different.

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

(d) Arctic foxes sometimes get a skin disease called mange.

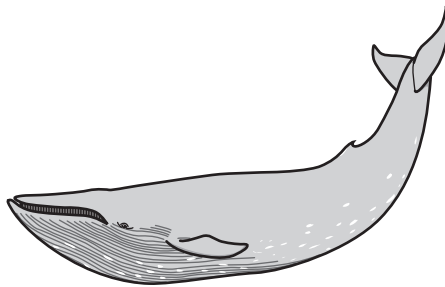
Mange is caused by parasites called mites.

Explain what is meant by the term **parasite**.

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

[Total: 6]

3 The blue whale is the biggest animal alive today.



(a) The population of blue whales has decreased because of hunting.

(i) Write down **one** reason why people hunt whales.

..... [1]

(ii) Some people think that all whale hunting should be completely stopped.

Why is it difficult to completely stop all whale hunting?

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

(b) Blue whales eat tiny crustaceans called krill.

Krill eat tiny sea plants called phytoplankton.

Phytoplankton make food by photosynthesis.

Photosynthesis happens more slowly when the phytoplankton are further below the surface of the sea.

This is because of limiting factors.

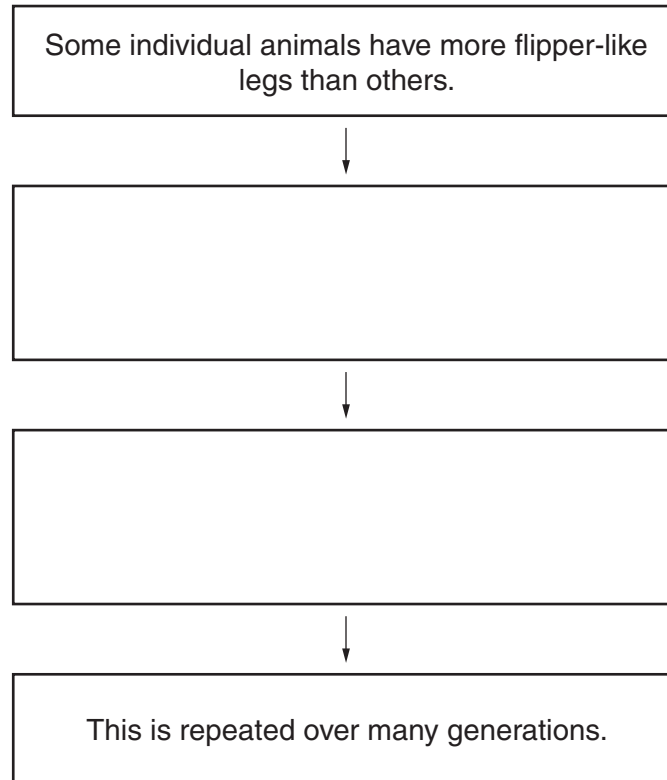
Suggest **two** limiting factors that slow down photosynthesis below the surface of the sea.

1
2 [2]

(c) Scientists think that whales evolved from animals that had legs and could live on land.

These animals spent some of their time in water, like otters or hippos do today.

Complete the flow diagram to show how these animals could have evolved into whales by natural selection.

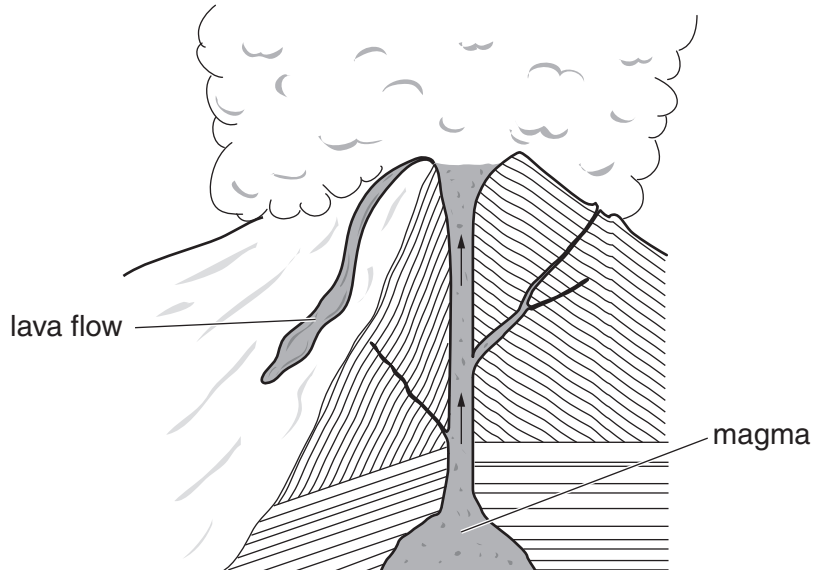


[2]

[Total: 7]

Section B – Module C2

4 This question is about volcanoes.



(a) Look at the diagram of a volcano.

The magma in the mantle can rise up through the Earth's crust.

Explain why.

Use ideas about density.

..... [1]

(b) Different types of magma have different compositions.

This causes different types of volcanic eruptions.

The different types of magma make different types of igneous rocks.

Draw lines to match each **type of volcanic eruption** with the correct **type of magma** and **type of rock** made.

You should draw four straight lines.

type of volcanic eruption	type of magma	type of rock
explosive	iron-rich	rhyolite
runny	silica-rich	basalt

[2]

(c) Geologists study volcanoes.

Suggest why.

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

[Total: 4]

5 This question is about the gases in the air.

(a) Complete the table to show the percentage of gases in clean air.

gas	percentage in clean air
.....	78%
.....	21%
carbon dioxide

[2]

(b) Air contains pollutants.

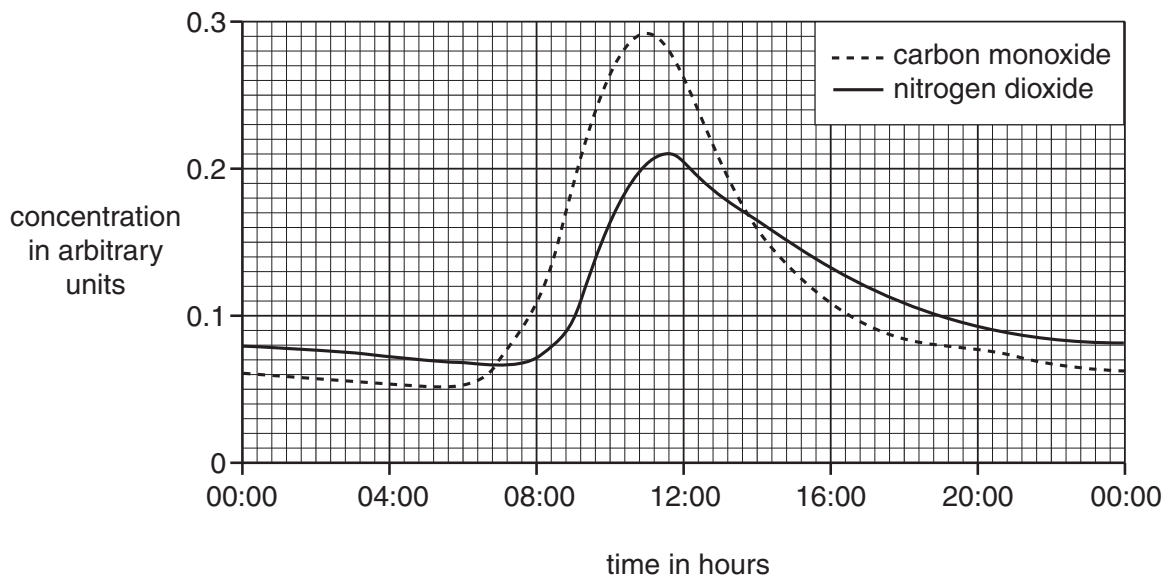
(i) Carbon monoxide is one pollutant given off from the exhaust gases of a car.

How is carbon monoxide made?

..... [1]

(ii) Look at the graph.

It shows how the concentrations of some pollutants in the air change over 24 hours.



At what time of day is the concentration of **nitrogen dioxide** the highest?

..... [1]

(c) Look at the following sentences.

They describe one possible theory for how the atmosphere evolved.

letter	sentence
A	Formation of water.
B	Carbon cycle now keeps the composition of the atmosphere almost constant.
C	Initial atmosphere of ammonia and carbon dioxide.
D	Increase in oxygen and nitrogen levels.
E	Photosynthetic organisms begin to make oxygen.
F	Degassing from the Earth's crust.

Put the sentences in the correct order.

Some have been done for you.

Order of sentences

[2]

[Total: 6]

6 Julie and Trevor investigate the reaction between zinc and sulfuric acid.

In the reaction, zinc sulfate and hydrogen are made.

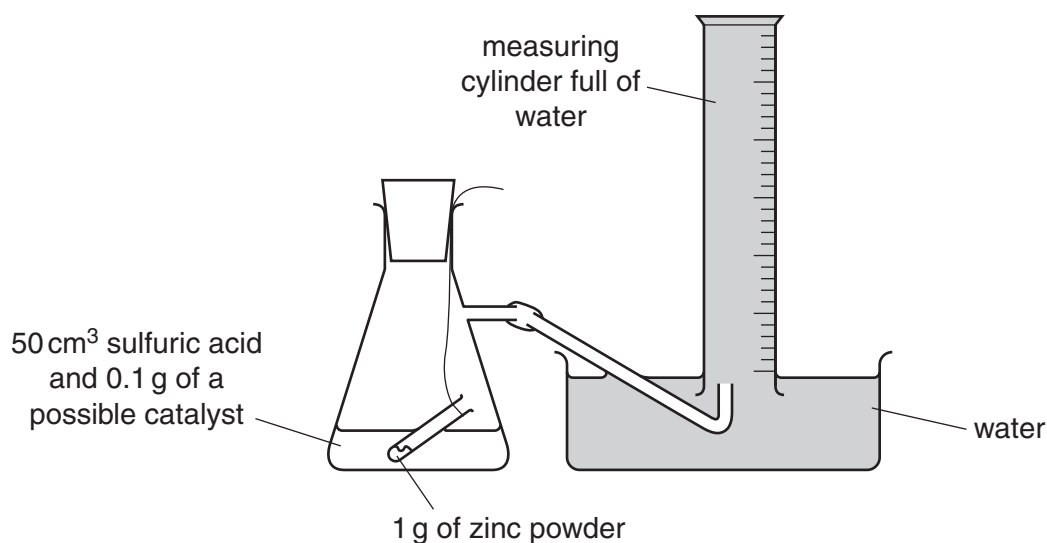
(a) Write a **word** equation for this reaction.

..... [1]

(b) Julie and Trevor do several experiments.

They want to find a substance that is a **catalyst** for the reaction.

The diagram shows the apparatus they use.



The flask is shaken to start the reaction.

They record the time taken to collect 50 cm³ of gas.

Look at the table. It shows Julie and Trevor's results.

possible catalyst used	appearance of catalyst	time to collect 50 cm ³ of gas in seconds	other observations
no catalyst added	–	65	colourless solution made
copper sulfate	blue solid	10	colourless solution made and zinc powder coated with a pink solid
copper powder	red-brown powder	19	red-brown powder remains
copper lumps	red-brown lumps	56	red-brown lumps left behind
sodium chloride	white solid	65	colourless solution made

(i) Copper powder and copper lumps are both catalysts for the reaction.

How can you tell?

Use information from the table.

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

(ii) The reaction goes faster if copper **powder** is used instead of copper **lumps**.

Explain why.

Use ideas about collisions between particles.

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

(iii) Julie and Trevor repeat the experiment with copper sulfate.

This time they use sulfuric acid that is **twice** as concentrated.

Predict the time it will take to collect 50 cm³ of gas.

..... [1]

[Total: 6]

7 James has fitted a new kitchen in his house.



(a) The table in James' kitchen is made of granite.

Why did James choose granite, instead of marble, for his table?

Use ideas about the hardness of the rocks.

..... [1]

(b) The taps in the kitchen are made of stainless steel.

Why did James choose steel, instead of iron, for his taps?

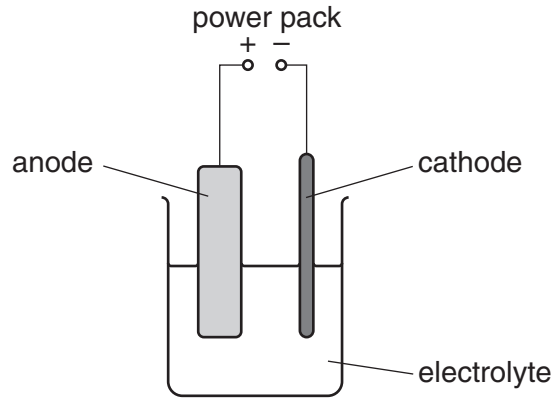
..... [1]

(c) The electrical wiring in the kitchen is made of copper.

Copper has to be purified by **electrolysis** before it can be used for electrical wiring.

Look at the diagram.

It shows the apparatus used to purify impure copper.



(i) What are the electrodes made of?

anode

cathode [1]

(ii) Write about what happens at each electrode.

anode

.....

cathode

..... [1]

[Total: 4]

Section C – Module P2

8 This question is about energy from the Sun.

Photocells use energy from the Sun.



Photocells have advantages and disadvantages as a source of electricity.

(a) Write down **one advantage** of using photocells.

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

(b) Write down **one disadvantage** of using photocells.

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

[Total: 2]

9 This question is about the cost of using electricity.

Nasim cooks a meal in a conventional oven.

It takes 3 hours to cook.

The oven has an average power of 3.5 kW.

(a) Calculate the number of kilowatt hours used to cook the meal.

.....
.....
answer kWh [1]

(b) Electricity costs 16 pence per unit (kWh).

Calculate the cost of cooking the meal.

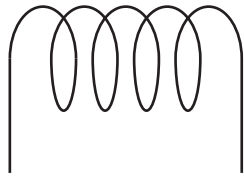
.....
answer pence [1]

[Total: 2]

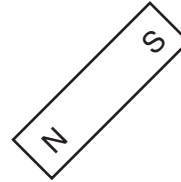
10 This question is about generating electricity.

Molly builds a generator to produce electricity.

She uses a magnet and a coil of wire.



coil of wire



magnet

Describe how Molly uses this equipment to generate a current.

In your answer you should

- draw a diagram to show how she uses the equipment
- describe how a current is produced
- describe how she could increase the current produced.

.....

.....

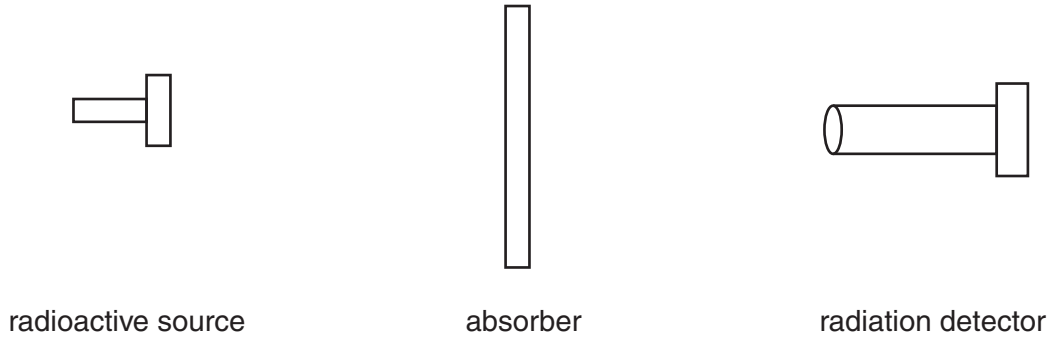
.....

..... [3]

[Total: 3]

11 This question is about the properties of nuclear radiation.

Look at the diagram.



Oliver records the counts per minute from the detector.

He repeats the experiment with the same radioactive source but with different absorbers.

Look at his results.

absorber	count rate at detector in counts per minute
none	1200
thin paper	1198
3mm aluminium	36
thick lead	36

Oliver thinks that the radioactive source is giving out beta (β) radiation.

Explain why he is correct.

In your answer write about how Oliver's results show

- it is not alpha (α) or gamma (γ) radiation
- why the count rate never reaches zero.

.....

.....

.....

.....

..... [3]

[Total: 3]

12 (a) Some objects in the Universe are close to Earth, others are far away.

Look at this list of distances.

- A Earth to the nearest asteroid belt.
- B Earth to the nearest star.
- C Earth's galaxy (Milky Way) to the nearest other galaxy.
- D Earth to the nearest black hole.
- E Earth to the nearest planet.

Put the distances in order starting with the **shortest** distance.

Write your answers in the boxes.

One has been done for you.

shortest distance

largest distance

		A		
--	--	---	--	--

[2]

(b) Asteroids are left over from the formation of the Solar System.

The asteroid belt is between Mars and Jupiter.

The asteroids have not joined together to form a new planet.

Suggest why.

.....

.....

..... [1]

(c) There is a small threat of the Earth being hit by a Near Earth Object.

Suggest how we can reduce this threat.

.....

.....

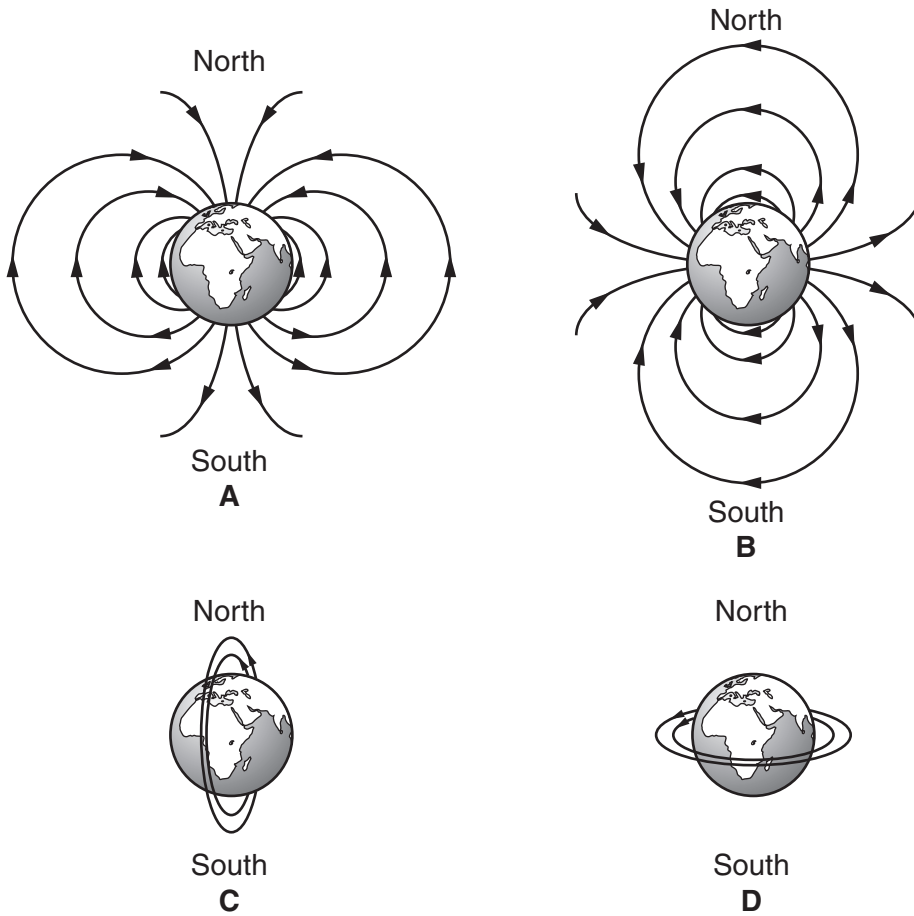
.....

..... [2]

[Total: 5]

13 The Earth is surrounded by a magnetic field.

(a) Look at the diagrams of the Earth.



Which diagram shows the correct shape of the Earth's magnetic field?

Choose from **A** **B** **C** **D**

answer

[1]

(b) The Sun emits **charged particles**.

They enter the Earth's magnetic field.

What effect does the Earth's magnetic field have on these charged particles?

.....

..... [1]

[Total: 2]

14 This question is about the Big Bang theory.

(a) Polly looks at the light from different galaxies.

(i) She notices that the light from one of the galaxies is shifted to the red end of the spectrum.

What does this tell you about this galaxy?

..... [1]

(ii) She notices that the light from a more distant galaxy has a greater red shift.

Explain why.

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

(b) The Sun is a medium weight star.

What does a medium weight star become at the end of its life?

Choose from

black hole neutron star red giant supernova white dwarf

answer [1]

[Total: 3]

END OF QUESTION PAPER



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The Periodic Table of the Elements

		1	2	Key										18	19	20								
				relative atomic mass	atomic symbol	name	atomic (proton) number																	
		1 H hydrogen 1	2 He helium 2																					
7	9	23	40	45	48	51	52	55	56	59	59	63.5	65	70	73	75	79	80	84	131				
Li lithium 3	Be beryllium 4	Na sodium 11	K potassium 19	Sc scandium 21	Ti titanium 22	V vanadium 23	Cr chromium 24	Mn manganese 25	Fe iron 26	Co cobalt 27	Ni nickel 28	Cu copper 29	Zn zinc 30	Ga gallium 31	Ge germanium 32	As arsenic 33	Se selenium 34	Br bromine 35	Kr krypton 36	Xe xenon 54				
85	88	133	137	139	178	181	184	186	190	192	195	197	201	204	207	209	209	209	209	209	[222]			
Rb rubidium 37	Sr strontium 38	Cs caesium 55	Ba barium 56	La* lanthanum 57	Hf hafnium 72	Ta tantalum 73	W tungsten 74	Re rhenium 75	Os osmium 76	Ir iridium 77	Pt platinum 78	Au gold 79	Hg mercury 80	Tl thallium 81	Pb lead 82	Bi bismuth 83	Po polonium 84	At astatine 85	Rn radon 86	Xe xenon 54				
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated													

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.