Name	
Current School	

Chemistry

Entrance exam for: 16+ (Sample)
Time allowed: 45 minutes
Total marks: 45

Please read this information before the examination starts

- Calculators may be used.
- A periodic table has been provided for you.

For office use only

Marks awarded:	
Comments:	

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Questions

Q1.

Argon is in group 0 of the periodic table.

Identify, using the periodic table on the back cover of this paper, which of these elements is in the same period as argon.

(1)

☒ **A** bromine

☒ **B** iron

☒ **C** magnesium

☒ **D** xenon

(Total for question = 1 mark)

Q2.

Nitrogen and oxygen are present in the air.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Oxygen has a low boiling point because there are

(1)

☒ **A** weak covalent bonds between the oxygen atoms

☒ **B** weak covalent bonds between the oxygen molecules

☒ **C** weak forces of attraction between the oxygen atoms

☒ **D** weak forces of attraction between the oxygen molecules

Q3.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Diesel oil contains alkanes.
These alkanes are part of an homologous series.

Which statement about compounds in this homologous series is true?

(1)

☐ **A** they have the same chemical formula

☐ **B** they have the same empirical formula

☐ **C** they have the same general formula

☐ **D** they have the same molecular formula

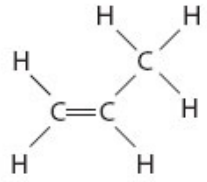
(Total for question = 1 mark)

Q4.

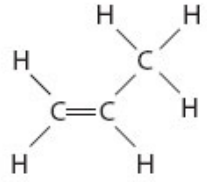
(i) Which of the following is the formula for a molecule of ethane?

Put a cross (☒) in the box next to your answer.

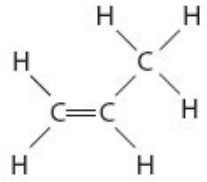
(1)



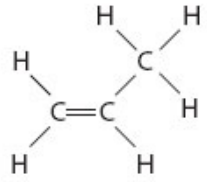
A CH_4



B C_2H_4



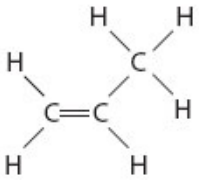
C C_2H_6



D C_6H_8

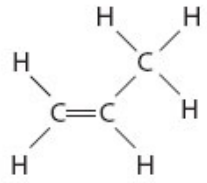
(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The structure of a molecule of a substance is shown.

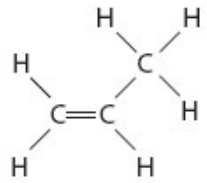


The substance is

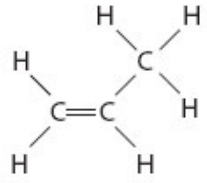
(1)



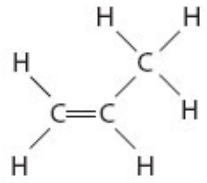
A ethene



B propane



C propene



D butane

Q5.

The molecular formula of butene is C_4H_8.

Which of the following is the empirical formula of butene?

(1)

☒ **A** CH

☒ **B** CH_2

☒ **C** C_4H_8

☒ **D** $(CH_2)_4$

(Total for question = 1 mark)

Q6.

A bottle of wine is opened and left exposed to the air for a few days.
The ethanol in the wine reacts with oxygen from the air to form ethanoic acid.

Complete the sentence by putting a cross (☒) in the box next to your answer.

In this reaction the ethanol is

(1)

☒ **A** hydrated

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

Q7.

Four gases were present in the Earth's early atmosphere.

Figure 1 shows the percentages of these gases thought to have been present.

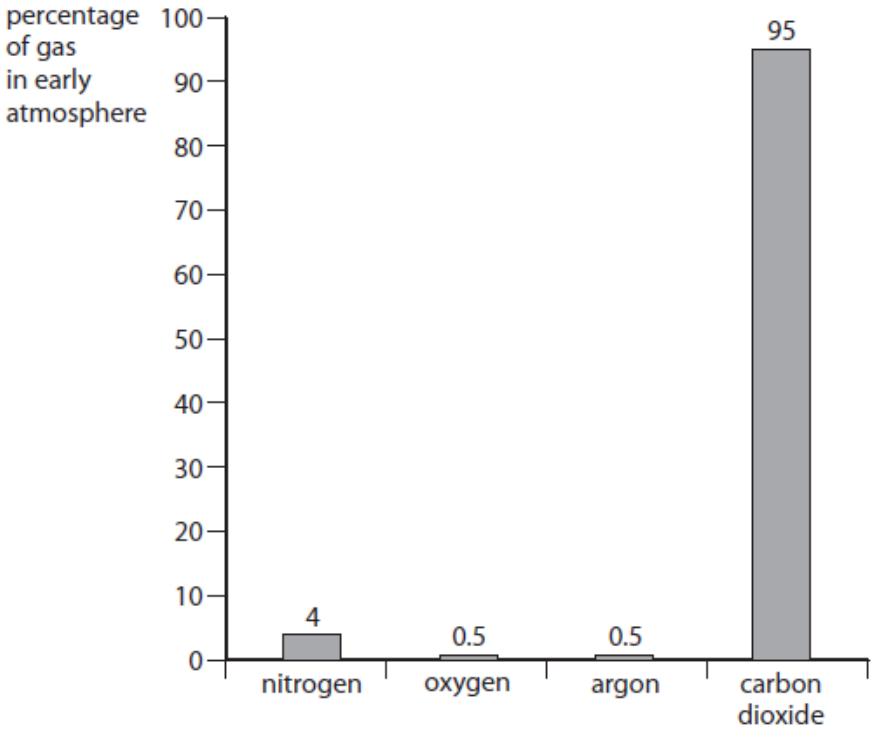


Figure 1

Figure 2 shows the percentages of these four gases in the atmosphere of the Earth today.

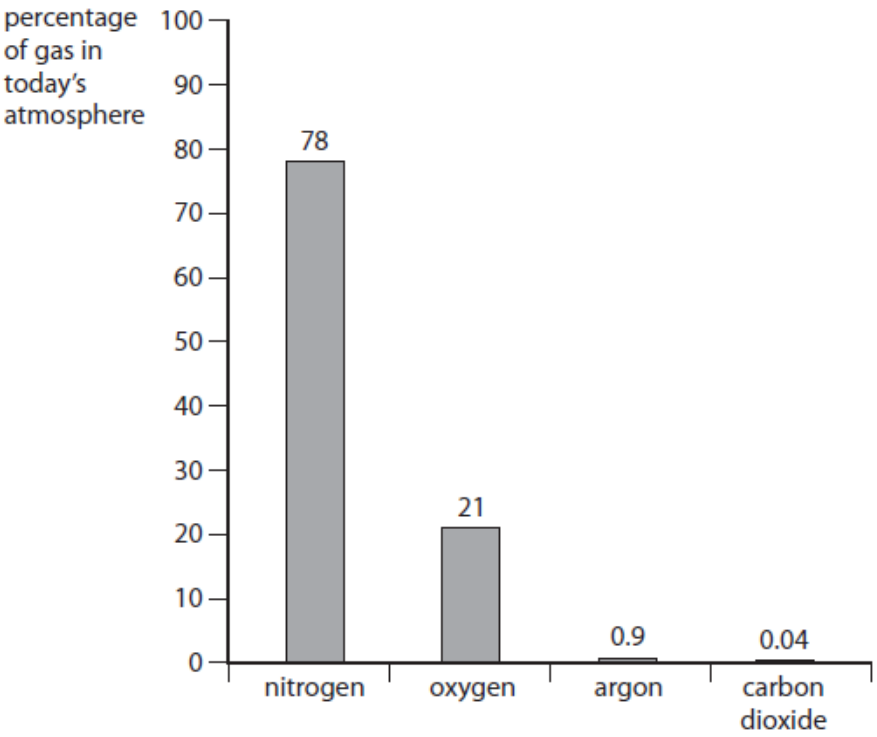


Figure 2

Which of the four gases has decreased by the largest percentage from the Earth's early atmosphere to today's atmosphere?

(1)

A argon

☒ **B** carbon dioxide

☒ **C** nitrogen

☒ **D** oxygen

(Total for question = 1 mark)

Q8.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

When chloride ions are added to a pale blue solution containing copper ions, the mixture turns yellow.

This is a reversible reaction.

pale blue solution + chloride ions ↔ yellow solution + water

What effect does the removal of chloride ions have on the colour of the yellow mixture?

(1)

☒ **A** does not change colour

☒ **B** turns blue

☒ **C** turns colourless

☒ **D** turns darker yellow

(Total for question = 1 mark)

Q9.

Answer the question with a cross in the box you think is correct ☒. If you change your

mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Magnesium reacts with dilute sulfuric acid to form magnesium sulfate and hydrogen gas.

A student wants to find out the effect of temperature on the rate of this reaction.

The student used the following method.

step 1 pour 25 cm^3 of dilute sulfuric acid into a conical flask

step 2 warm the acid until its temperature is 30 °C

step 3 add a piece of magnesium to the acid

step 4 start a stopwatch

step 5 wait until the reaction has finished

step 6 stop the stopwatch

step 7 repeat steps 1–6 but at 50 °C.

Which piece of equipment can be used to find the volume of 25 cm^3 of sulfuric acid?

(1)

☒ **A** balance

☒ **B** measuring cylinder

☒ **C** ruler

☒ **D** thermometer

(Total for question = 1 mark)

Q10.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about electrolysis.

A sample of molten potassium bromide is electrolysed.

What are the two products formed?

(1)

☒ **A** hydrogen and oxygen

☒ **B** hydrogen and bromine

☒ **C** potassium and oxygen

☒ **D** potassium and bromine

(Total for question = 1 mark)

Q11.

Molten lead bromide is electrolysed.

The products of this electrolysis are

(1)

☒ **A** hydrogen and bromine

☒ **B** hydrogen and oxygen

☒ **C** lead and bromine

☒ **D** lead and oxygen

(Total for question = 1 mark)

Q12.

Molten zinc chloride is an electrolyte.

(i) Which row shows the products formed at the anode and at the cathode when molten zinc chloride is electrolysed?

(1)

	product at anode	product at cathode
☒ A	oxygen	zinc
☒ B	chlorine	hydrogen
☒ C	chlorine	zinc
☒ D	oxygen	hydrogen

(ii) Which of the following is the reason why molten zinc chloride is an electrolyte?

(1)

☒ **A** it contains molecules that can move

☒ **B** it has a giant structure

☒ **C** it contains delocalised electrons

☒ **D** it contains ions that can move

(Total for question = 2 marks)

Q13.

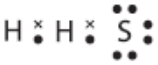
Hydrogen sulphide, H_2S, is a simple molecular, covalent compound.

(i) A hydrogen atom has one electron in its outer shell.

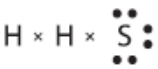
A sulfur atom has six electrons in its outer shell.

Which of the following is the dot and cross diagram of a molecule of hydrogen sulfide?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(ii) Which row in Figure 6 shows the properties of a simple molecular, covalent compound such as hydrogen sulfide?

(1)

	melting point	boiling point	conduction of electricity
☒ **A**	high	high	poor conductor
☒ **B**	high	high	good conductor only when liquid
☒ **C**	low	low	poor conductor
☒ **D**	high	high	good conductor

Figure 6

(Total for question = 2 marks)

Q14.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

In this reaction, ethanol is

(1)

☒ **A** dehydrated

☒ **B** neutralised

☒ **C** neutralised

☒ **D** reduced

Q15.

Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

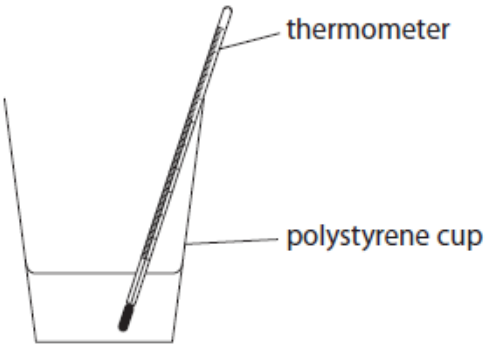


Figure 1

The dissolving of this solid in water is an exothermic change.
The experiment is repeated a number of times.
Compared with the initial temperature of the water, the final temperature of the solution is

(1)

☒ **A** always higher

☒ **B** always lower

☒ **C** sometimes higher and sometimes lower

☒ **D** always unchanged

(Total for question = 1 mark)

Q16.

Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

In an experiment equal-sized pieces of lithium, sodium and potassium are added to separate samples of water.

A flame is produced only with potassium because potassium

(1)

☒ **A** is the softest metal

☒ **B** has the lowest melting point

☒ **C** is the most reactive

☒ **D** is the only flammable metal

(Total for question = 1 mark)

Q17.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction for the extraction of aluminium from its ore involves

(1)

☒ **A** heating with carbon

☒ **B** thermal decomposition

☒ **C** reduction

☒ **D** neutralisation

Q18.

Crude oil is found in the Earth's crust.

Which of the statements about crude oil is correct?

(1)

☒ **A** crude oil is a finite resource

☒ **B** crude oil is a mixture of the elements hydrogen and carbon

☒ **C** all of the molecules in crude oil contain rings of carbon atoms

☒ **D** crude oil is used in cars as a fuel

(Total for question = 1 mark)

Q19.

Which of these is the formula of a molecule of a hydrocarbon?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** CH_3COOCH_3

☒ **B** CH_3CH_2Cl

☒ **C** CH_3CH_3

☒ **D** CH_3COOH

Q20.

The formula of ammonium sulfate is $(NH_4)_2SO_4$.

What is the empirical formula of ammonium sulfate?

(1)

☒ **A** NHSO

☒ **B** NH_2SO_2

☒ **C** NH_4SO_4

☒ **D** $N_2H_8SO_4$

(Total for question = 1 mark)

Q21.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Group 1 in the periodic table contains

(1)

- ☒ **A** transition metals
- ☒ **B** noble gases
- ☒ **C** halogens
- ☒ **D** alkali metals

Q22.

Transition metals and group 1 metals have many properties in common because they are all metals.

However some properties of transition metals are different from properties of group 1 metals.

Which is a property of transition metals but not of group 1 metals?

(1)

- ☒ **A** good conductor of electricity
- ☒ **B** high melting point
- ☒ **C** malleable
- ☒ **D** shiny when cut or polished

(Total for question = 1 mark)

Q23.

Butene reacts with steam to produce butanol.

$$C_4H_8 + H_2O \rightarrow C_4H_9OH$$

What type of reaction takes place between butene and steam?

(1)

- ☒ **A** addition

☒ **B** dehydration

☒ **C** neutralisation

☒ **D** substitution

(Total for question = 1 mark)

Q24.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

When crude oil is fractionally distilled, the demand for some fractions is more than the amount produced.

Figure 11 shows the relative amounts of each fraction in a crude oil and the relative demand for each of these fractions.

fraction	relative amount	relative demand
gases	2	6
petrol	12	29
kerosene	16	11
diesel oil	24	29
fuel oil	37	21
bitumen	9	4

Figure 11

Which of the following shows the fractions where the relative demand is greater than the relative amount in the crude oil?

(1)

☒ **A** kerosene, diesel oil, bitumen

☒ **B** gases, petrol, diesel oil

☒ **C** gases, petrol, kerosene

☒ **D** petrol, diesel oil, fuel oil

(Total for question = 1 mark)

Q25.

When solid ammonium chloride is added to water a colourless solution is formed.

What type of chemical change causes a decrease in temperature?

(1)

☒ **A** combustion

☒ **B** endothermic

☒ **C** exothermic

☒ **D** neutralisation

(Total for question = 1 mark)

Q26.

Which of the following rows gives the colours of the group 7 elements chlorine and bromine at room temperature?

(1)

	chlorine	bromine
☒ **A**	red-brown	purple
☒ **B**	yellow-green	grey
☒ **C**	yellow-green	red-brown
☒ **D**	grey	red-brown

(Total for question = 1 mark)

Q27.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about some of the elements in group 7 of the periodic table.

Which row in the table correctly shows the colours and physical states of the elements at room temperature?

(1)

☐ **A**	iodine: purple gas	bromine: yellow liquid
☐ **B**	chlorine: pale green gas	iodine: brown solid
☐ **C**	bromine: red-brown liquid	chlorine: yellow liquid
☐ **D**	iodine: dark grey solid	bromine: red-brown liquid

(Total for question = 1 mark)

Q28.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Diesel oil contains alkanes.
These alkanes are part of an homologous series.

Which statement about compounds in this homologous series is true?

(1)

☒ **A** they have the same chemical formula

☒ **B** they have the same empirical formula

☒

C they have the same general formula

☒ **D** they have the same molecular formula

(Total for question = 1 mark)

Q29.

Most of the fuels used today are obtained from crude oil.

Which statement about crude oil is correct?

(1)

☒ **A** crude oil is a compound of different hydrocarbons

☒ **B** crude oil is a mixture of hydrocarbons

☒ **C** crude oil contains different hydrocarbons, all with the same molecular formula

☒ **D** crude oil is an unlimited supply of hydrocarbons

(Total for question = 1 mark)

Q30.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Chlorine has an atomic number of 17.

Figure 3 shows the arrangement of electrons in an atom of chlorine.

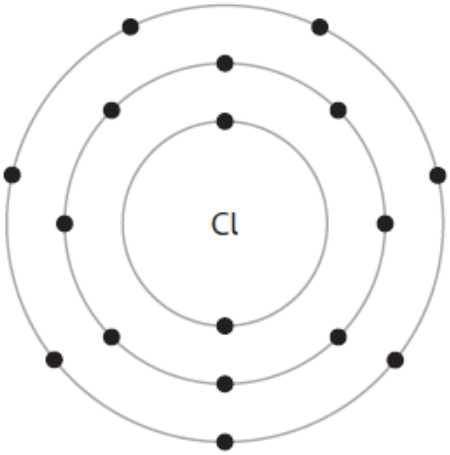


Figure 3

(i) What is the electronic configuration of this atom?

(1)

☒ **A** 10.7

☒ **B** 17

☒ **C** 2.8.7

☒ **D** 7.8.2

(ii) Explain, using Figure 3, why chlorine belongs to group 7 of the periodic table.

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

Q31.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

When copper sulfate solution reacts with sodium hydroxide solution, a precipitate of copper

hydroxide and a solution of sodium sulfate are formed.

The equation is

$$CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$$

The formula of the sodium ion is Na^+.

What is the formula of the sulfate ion?

(1)

☒ **A** SO_4^+

☒ **B** SO_4^-

☒ **C** SO_4^{2+}

☒ **D** SO_4^{2-}

(Total for question = 1 mark)

Q32.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution?

(1)

☒ **A** crystallising

☒ **B** diluting

☒ **C** dissolving

☒ **D** melting

(Total for question = 1 mark)

Q33.

The three states of matter are solid, liquid and gas.

What is the name of the change of state when a liquid changes into a solid?

(1)

☒ **A** condensation

☒ **B** evaporation

☒ **C** freezing

☒ **D** melting

(Total for question = 1 mark)

Q34.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

Magnesium has an atomic number of 12.

Which line in the table shows the correct numbers of protons, neutrons and electrons in a positively charged magnesium ion?

(1)

	number of		
	protons	neutrons	electrons
☒ **A**	10	12	12
☒ **B**	10	12	10
☒ **C**	12	10	12
☒ **D**	12	12	10

(Total for question = 1 mark)

Q35.

Sodium has an atomic number of 11.

Which line in the table shows the correct numbers of protons, neutrons and electrons in a positively charged sodium ion, Na^+?

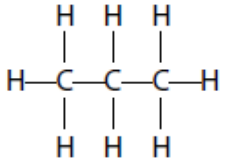
(1)

	number of		
	protons	**neutrons**	**electrons**
☒ **A**	10	12	11
☒ **B**	10	11	10
☒ **C**	11	10	11
☒ **D**	11	12	10

(Total for question = 1 mark)

Q36.

The structure of a molecule of propane is shown as



Which product is formed when there is incomplete combustion of propane?

(1)

☒ **A** sulfur dioxide

☒ **B** oxygen

☒ **C** hydrogen

☒ **D** carbon monoxide

(Total for question = 1 mark)

Q37.

An aluminium atom has the atomic number 13 and the mass number 27.

Which row shows the numbers of subatomic particles present in an aluminium ion, Al^{3+}?

(1)

	protons	neutrons	electrons
☒ **A**	13	14	13
☒ **B**	13	14	10
☒ **C**	14	13	10
☒ **D**	14	13	17

(Total for question = 1 mark)

Q38.

Sodium reacts with chlorine to form sodium chloride.

Which of these is the formula for sodium chloride?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** SCl

☒ **B** NaOCl

☒ **C** NaCl

☒ **D** SOCl

Q39.

When iron rusts it forms hydrated iron oxide, $Fe_2O_3.H_2O$.

$$4Fe + 3O_2 + 2H_2O \rightarrow 2Fe_2O_3.H_2O$$

(1)

In this reaction iron is

☒ **A** decomposed

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

(Total for question = 1 mark)

Q40.

Substance X is a gas at room temperature.
It is a simple molecular, covalent substance.

Which row of the table shows the properties that substance X is most likely to have?

(1)

	boiling point in °C	relative solubility in water
☒ **A**	–6	low
☒ **B**	600	high
☒ **C**	–6	high
☒ **D**	600	low

(Total for question = 1 mark)