AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.1.1 ATOMIC STRUCTURE, SYMBOLS, RELATIVE ATOMIC MASS, CHARGE AND ISOTOPES (PACK 6)

SCORE	PERCENTAGE
/114	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

The two carbon atoms represented below are isotopes.

ISOTOPE 1		ISOTOPE 2
14 C	mass number	12 C
6	proton number	6

(a) Describe **two** ways in which the isotopes are similar.

_____

_____

(2)

(b) Describe as fully as you can **one** way in which they are different.

_____

_____

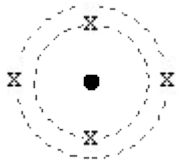
_____

(2)

(Total 4 marks)

Q2.

(a) The diagram shows the electronic structure of a particular element.



In a similar way, show the electronic structure of another element from the same group in the periodic table and name the element you select.

Name of element selected _____

(4)

STEMUP.CO.UK

(b) The element lithium gives a moderate reaction with cold water, releasing hydrogen and forming a solution of lithium hydroxide.

Describe how sodium is similar to and how it is different from lithium in its chemical reaction with cold water.

Explain any similarity or difference in terms of their atomic structure.

Similarity. _____

Reason. _____

_____

_____

Difference. _____

Reason. _____

_____

_____

(5)

(Total 9 marks)

Q3.

(a) Balance these chemical equations.

(i) H_2 + O_2 → H_2O

(1)

(ii) Al + O_2 → Al_2O_3

(1)

(b) Briefly explain why an unbalanced chemical equation cannot fully describe a reaction.

_____

_____

_____

_____

(2)

(Total 4 marks)

Q4.

Sodium carbonate reacts with acids.

(i) Complete the word equation.

sodium carbonate + hydrochloric acid → sodium chloride + _____ + water

(1)

STEMUP.CO.UK

(ii) Name the salt produced if sodium carbonate reacts with dilute nitric acid.

_____

(1)

(Total 2 marks)

Q5.

(a) The formula for ammonia is NH_3. What does the formula tell you about each molecule of ammonia?

_____

_____

_____

_____

(3)

(b) Ammonia is used to make nitric acid (HNO_3). Calculate the formula mass (Mr) for nitric acid. (Show your working).

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q6.

(a) Balance these chemical equations.

(i) H_2 + O_2 → H_2O

(1)

(ii) Al + O_2 → Al_2O_3

(1)

(b) Briefly explain why an unbalanced chemical equation cannot fully describe a reaction.

_____

_____

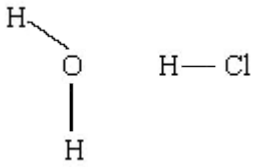
_____

_____

(2)

STEMUP.CO.UK

(c) Explain, as fully as you can, why a water molecule contains two hydrogen atoms but a hydrogen chloride molecule contains only one.



(You may use a diagram in your answer if you wish).

_____

_____

_____

_____

(3)

(Total 7 marks)

Q7.

You will find it helpful to use the information on the Data Sheet when answering this question.

In the nucleus of an aluminium atom are:

13 protons
and 14 neutrons.

(a) Complete these sentences.

(i) The mass number of the aluminium atom is _____ .

(ii) In an atom of aluminium there are _____ electrons.

(2)

(b) Why is an aluminium atom electrically neutral?

_____

_____

_____

(2)

(c) Complete the table for the element fluorine.

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom	9		9
Fluoride atom		10	

STEMUP.CO.UK

(3)

(Total 7 marks)

Q8.

The formula for the compound hydrogen peroxide is H_2O_2.

Write down everything that the formula tells you about each molecule of hydrogen peroxide.

_____

_____

_____

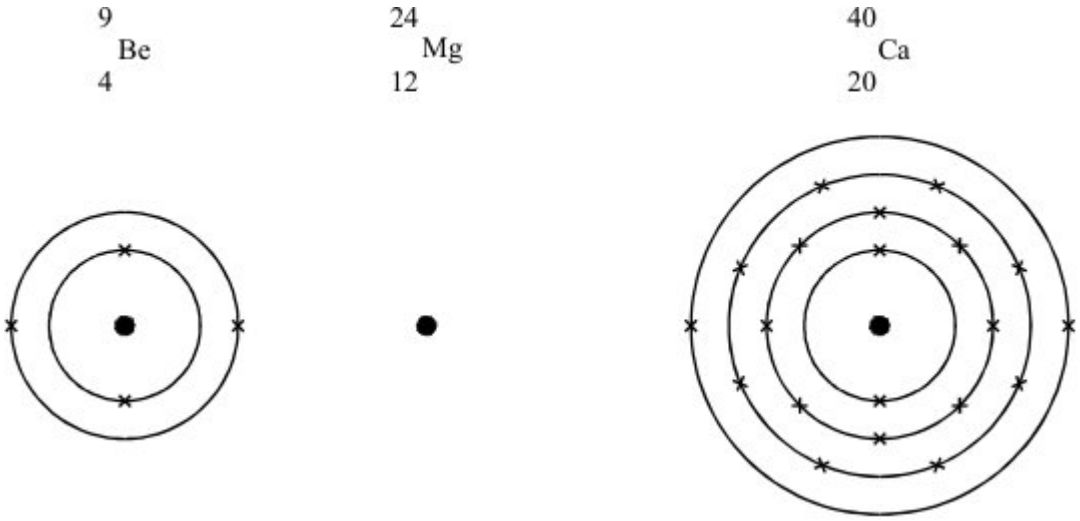
_____

_____

(Total 4 marks)

Q9.

Three elements in Group 2 of the periodic table are beryllium (Be), magnesium (Mg) and calcium (Ca). Their mass numbers and proton numbers are shown below. The electronic structure is shown for beryllium and calcium.



(a) In a similar way, draw the electronic structure for magnesium.

(3)

(b)
- The three elements have similar chemical properties
- The reactivity of these elements with non-metals, increases from beryllium to magnesium to calcium.

Explain these two statements in terms of atomic structure.

_____

_____

STEMUP.CO.UK

_____

_____

_____

_____

(6)

(Total 9 marks)

Q10.

The information on the Data Sheet will be helpful in answering this question.

(a) Calculate the formula mass (M_r) of the compound iron (III) oxide, Fe_2O_3.

(Show your working.)

_____

_____

_____

_____

_____

(3)

(b) Calculate the mass of iron produced when 32g of iron (III) oxide is completely reduced by aluminium.

The reaction is shown in the symbol equation:

$$Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$$

(Show your working.)

_____

_____

_____

_____

Answer = _____ grams

(3)

(Total 6 marks)

Q11.

Atoms of calcium, phosphorus and fluorine are represented below, each with its mass number and proton number.

STEMUP.CO.UK

40	31	19	← mass numbers
Ca	P	F	
20	15	9	← proton numbers

(a) Use this information to complete the table.

	CALCIUM	PHOSPHORUS	FLUORINE
Number of protons in the nucleus	20		9
Number of neutrons in the nucleus	20	16	
Number of electrons		15	9

(3)

(b) Calcium and fluorine atoms can combine to form the compound calcium fluoride, CaF_2.

The fluoride ion is represented by F^-.

(i) Explain how the fluorine atom forms a fluoride ion.

_____

_____

(2)

(ii) How is the calcium ion represented?

_____

(2)

(c) Phosphorus and fluorine form a covalent compound, phosphorus trifluoride.

Complete the sentences below which are about this compound.

Phosphorus trifluoride is made up of phosphorus and fluorine _____

These are joined together by sharing pairs of _____ to form

phosphorus trifluoride _____ .

(3)

(d) (i) Sodium chloride, an ionic compound, has a high melting point whereas paraffin wax, a molecular compound, melts easily.

Explain why.

_____

_____

_____

_____

(2)

STEMUP.CO.UK

(ii) Molten ionic compounds conduct electricity but molecular compounds are non-conductors, even when liquid.

Explain why.

_____

_____

_____

(2)

(Total 14 marks)

Q12.

Here is a symbol equation, with state symbols, for a chemical reaction between solutions of lead nitrate and potassium chloride.

$$Pb(NO_3)_{2\,(aq)} + 2\,KCl_{(aq)} \longrightarrow 2KNO_{3\,(aq)} + PbCl_{2\,(s)}$$

The equation tells you the formulae of the two products of the reaction.

(a) What are the names of the **two** products?

1. _____

2. _____

(2)

(b) What else does the equation tell you about these products?

_____

_____

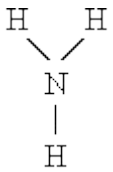
_____

(2)

(Total 4 marks)

Q13.

The diagram shows one molecule of the compound ammonia.



Write down everything that the diagram tells you about each molecule of ammonia.

_____

_____

_____

STEMUP.CO.UK

_____

_____

_____

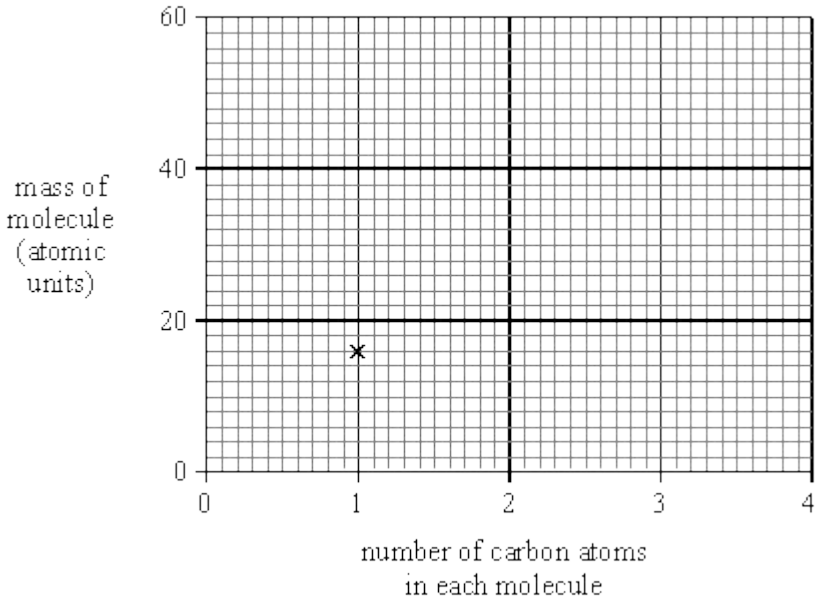
(Total 4 marks)

Q14.

The table gives some information about a family of molecules in crude oil.

NUMBER OF CARBON ATOMS IN MOLECULE	MASS OF MOLECULE (atomic units)
1	16
2	30
4	58

(a) Show information from the table in the most appropriate way on the grid.



(3)

(b) What is the mass of a molecule with three carbon atoms?

_____

(1)

(c) The other atoms in each molecule are all hydrogen atoms.
What family of substances do all the molecules belong to?

_____

(1)

(d) The mass of a carbon atom is 12 atomic units.
The mass of a hydrogen atom is 1 atomic unit.

STEMUP.CO.UK

So the molecule with one carbon atom has four hydrogen atoms.
Its formula is CH_4.

Write down the formula:

(i) of the molecule with two carbon atoms _____

(ii) of a molecule from the same family with five carbon atoms _____

(2)

(Total 7 marks)

Q15.

(a) The formula for the chemical compound magnesium sulphate is $MgSO_4$.

Calculate the relative formula mass (M_r)of this compound. (Show your working.)

_____

_____

_____

_____

(2)

(b) Magnesium sulphate can be made from magnesium and dilute sulphuric acid.

This is the equation for the reaction.

$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

Calculate the mass of magnesium sulphate that would be obtained from 4g of magnesium.
(Show your working.)

_____

_____

_____

_____

_____

_____

Answer_____ g

(2)

(Total 4 marks)

Q16.

These are the electronic structures of the atoms of three different elements.

STEMUP.CO.UK

2.8.1	2.8.8	2.8.8.1
element A	element B	element C

(a) Identify elements A and B.

Element A is _____

Element B is _____

(2)

(b) (i) Why is element C more reactive than element A?

_____

_____

_____

_____

_____

_____

(2)

(ii) Why is element B unreactive?

_____

_____

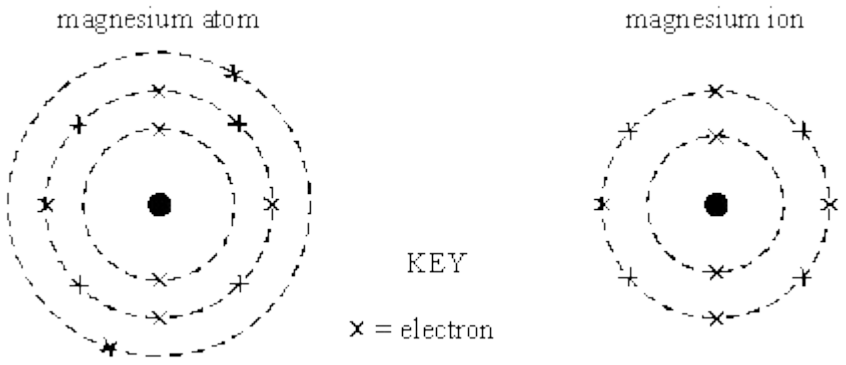
_____

(2)

(Total 6 marks)

Q17.

(a) The diagrams below show the electronic structure of a magnesium atom and a magnesium ion.



What is the charge on the magnesium ion? _____

(2)

(b) Calcium bromide has the formula $CaBr_2$.

STEMUP.CO.UK

What does this tell you about the ions in this compound?

_____

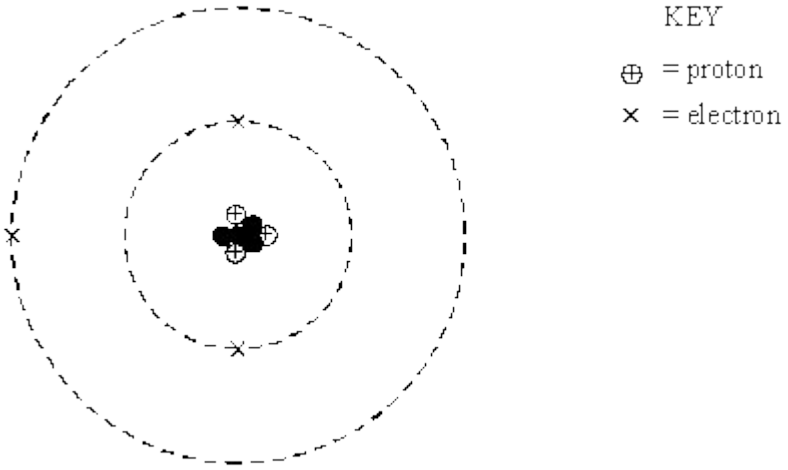
_____

(2)

(Total 4 marks)

Q18.

The diagram shows the structure of a lithium atom.



(a) (i) What is represented by ● _____

(ii) What is represented by  _____

(2)

(b) What is the symbol for lithium? _____

(1)

(Total 3 marks)

Q19.

This question is about the structure of atoms.

(a) Choose words from the list to complete the sentences below.

electrons ions neutrons protons

In an atom, the particles with a negative charge are called _____

Particles in the nucleus with no charge are called _____

An atom has no overall charge because is has the same number of electrons and

_____

(3)

(b) Two isotopes of the element carbon are:

12 14

STEMUP.CO.UK

$^{12}_{6}C$ and $^{13}_{6}C$

Complete the table of information for these two isotopes.

	ATOMIC NUMBER	MASS NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS
Isotope $^{12}_{6}C$	6	12	6	6
Isotope $^{13}_{6}C$	6		6	

(2)

(Total 5 marks)

Q20.

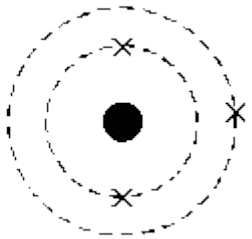
(a) Write down the symbols for

lithium _____

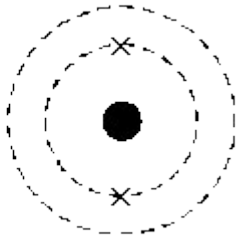
fluorine _____

(2)

(b) The electronic structure of a lithium atom can be shown like this:

2,1 or  where **x** is an electron.

In a similar way, complete this diagram to show the electronic structure of a fluorine atom.

2,7 or 

(1)

(c) A lithium atom can lose one electron to form a lithium ion which can be written **$(2)^+$**
A fluorine atom can gain one electron to form a fluoride ion.

Choose from the list the correct way to write the fluoride ion.

$(2,6)^+$ **$(2,7)^+$** **$(2,7)^-$** **$(2,8)^+$** **$(2,8)^-$**

STEMUP.CO.UK

Answer _____

(2)

(Total 5 marks)

STEMUP.CO.UK