AQA A-LEVEL CHEMISTRY · 7405

CHEMISTRY



EXAM QUESTION PACK

3.2.1 PERIODICITY

SCORE	PERCENTAGE
/90	%

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Q1.

Which is the correct classification for the element yttrium (Y)?

A s block ⬭

B p block ⬭

C d block ⬭

D f block ⬭

(Total 1 mark)

Q2.

Which element is in the f-block of the Periodic Table?

A Palladium ⬭

B Phosphorus ⬭

C Platinum ⬭

D Plutonium ⬭

(Total 1 mark)

Q3.

Which element is in the d-block of the Periodic Table?

A Selenium ⬭

B Antimony ⬭

C Tantalum ⬭

D Lead ⬭

(Total 1 mark)

Q4.

(a) Nickel is a metal with a high melting point.

(i) State the block in the Periodic Table that contains nickel.

_____

(1)

(ii) Explain, in terms of its structure and bonding, why nickel has a high melting point.

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_____

_____

_____

_____

_____

(2)

(iii) Draw a labelled diagram to show the arrangement of particles in a crystal of nickel.
In your answer, include at least six particles of each type.

(2)

(iv) Explain why nickel is ductile (can be stretched into wires).

_____

_____

_____

(1)

(b) Nickel forms the compound nickel(II) chloride ($NiCl_2$).

(i) Give the full electron configuration of the Ni^{2+} ion.

_____

(1)

(ii) Balance the following equation to show how anhydrous nickel(II) chloride can be obtained from the hydrated salt using $SOCl_2$
Identify **one** substance that could react with both gaseous products.

.....$NiCl_2.6H_2O(s)$ + ... $SOCl_2(g)$ ⟶ .....$NiCl_2(s)$ + ...$SO_2(g)$ + ...$HCl(g)$

Substance _____

(2)

(Total 9 marks)

Q5.

The element rubidium exists as the isotopes ^{85}Rb and ^{87}Rb

(a) State the number of protons and the number of neutrons in an atom of the isotope

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^{85}Rb

Number of protons _____

Number of neutrons _____

(2)

(b) (i) Explain how the gaseous atoms of rubidium are ionised in a mass spectrometer

_____

_____

_____

_____

(2)

(ii) Write an equation, including state symbols, to show the process that occurs when the **first** ionisation energy of rubidium is measured.

_____

(1)

(c) The table shows the first ionisation energies of rubidium and some other elements in the same group.

Element	sodium	potassium	rubidium
First ionisation energy / kJ mol^{-1}	494	418	402

State **one** reason why the first ionisation energy of rubidium is lower than the first ionisation energy of sodium.

_____

_____

_____

(1)

(d) (i) State the block of elements in the Periodic Table that contains rubidium.

_____

(1)

(ii) Deduce the full electron configuration of a rubidium atom.

_____

(1)

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(e) A sample of rubidium contains the isotopes ^{85}Rb and ^{87}Rb only.
The isotope ^{85}Rb has an abundance 2.5 times greater than that of ^{87}Rb

Calculate the relative atomic mass of rubidium in this sample.
Give your answer to one decimal place.

_____

_____

_____

_____

(3)

(f) By reference to the relevant part of the mass spectrometer, explain how the abundance of an isotope in a sample of rubidium is determined.

Name of relevant part _____

Explanation _____

_____

_____

(2)

(g) Predict whether an atom of ^{88}Sr will have an atomic radius that is larger than, smaller than or the same as the atomic radius of ^{87}Rb. Explain your answer.

Atomic radius of ^{88}Sr compared to ^{87}Rb _____

Explanation _____

_____

_____

_____

(3)
(Total 16 marks)

Q6.

The elements phosphorus, sulfur, chlorine and argon are in the p block of the Periodic Table.

(a) State why these elements are classified as p block elements.

_____

(1)

(b) State the trend in atomic radius from phosphorus to chlorine and explain the trend.

Trend _____

Explanation _____

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_____

_____

(3)

(c) In terms of structure and bonding, explain why sulfur has a higher melting point than phosphorus.

_____

_____

_____

_____

(3)

(d) In terms of atomic structure, explain why the van der Waals' forces in liquid argon are very weak.

_____

_____

_____

(2)

(Total 9 marks)

Q7.

(a) State the meaning of the term *first ionisation energy* of an atom.

_____

_____

(2)

(b) Complete the electron arrangement for the Mg^{2+} ion.

$1s^2$ _____

(1)

(c) Identify the block in the Periodic Table to which magnesium belongs.

_____

(1)

(d) Write an equation to illustrate the process occurring when the **second** ionisation energy of magnesium is measured.

_____

(1)

(e) The Ne atom and the Mg^{2+} ion have the same number of electrons. Give **two** reasons why the first ionisation energy of neon is lower than the third ionisation energy of magnesium.

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Reason 1 _____

Reason 2 _____

(2)

(f) There is a general trend in the first ionisation energies of the Period 3 elements, Na – Ar

(i) State and explain this general trend.

Trend _____

Explanation _____

_____

_____

(ii) Explain why the first ionisation energy of sulphur is lower than would be predicted from the general trend.

_____

_____

_____

(5)

(Total 12 marks)

Q8.

(a) (i) Complete the electronic configuration of aluminium.

$1s^2$ _____

(ii) State the block in the Periodic Table to which aluminium belongs.

_____

(2)

(b) Describe the bonding in metals.

_____

_____

_____

(2)

(c) Explain why the melting point of magnesium is higher than that of sodium.

_____

_____

_____

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_____

(3)

(d) Explain how metals conduct electricity.

_____

_____

_____

(2)

(Total 9 marks)

Q9.

(a) Complete the following table.

Particle	Relative charge	Relative mass
Proton		
Neutron		
Electron		

(3)

(b) An atom of element **Z** has two more protons and two more neutrons than an atom of $^{34}_{16}S$. Give the symbol, including mass number and atomic number, for this atom of **Z**.

_____

(2)

(c) Complete the electronic configurations for the sulphur atom, S, and the sulphide ion, S^{2-}.

S $1s^2$ _____

S^{2-} $1s^2$ _____

(2)

(d) State the block in the Periodic Table in which sulphur is placed and explain your answer.

Block _____

Explanation _____

(2)

(e) Sodium sulphide, Na_2S, is a high melting point solid which conducts electricity when molten. Carbon disulphide, CS_2, is a liquid which does not conduct electricity.

(i) Deduce the type of bonding present in Na_2S and that present in CS_2

Bonding in Na_2S _____

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Bonding in CS_2 _____

(ii) By reference to all the atoms involved explain, in terms of electrons, how Na_2S is formed from its atoms.

_____

_____

(iii) Draw a diagram, including all the outer electrons, to represent the bonding present in CS_2

(iv) When heated with steam, CS_2 reacts to form hydrogen sulphide, H_2S, and carbon dioxide.
Write an equation for this reaction.

_____

(7)

(Total 16 narks)

Q10.

(a) Explain why certain elements in the Periodic Table are classified as p-block elements. Illustrate your answer with an example of a p-block element and give its electronic configuration.

_____

_____

_____

_____

_____

_____

(3)

(b) Explain the meaning of the term *periodicity* as applied to the properties of rows of elements in the Periodic Table. Describe and explain the trends in atomic radius, in electronegativity and in conductivity for the elements sodium to argon.

_____

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(13)
(Total 16 marks)

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