Atomic structure – 2022 June AS Chemistry 9701

1. June/2022/Paper_11/No.1

    Which atom has its outermost electron in an orbital of the shape shown, with principal quantum number 3?

    A   sodium

    B   chlorine

    C   calcium

    D   bromine

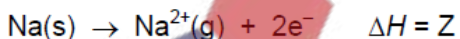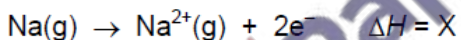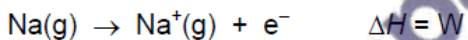2. June/2022/Paper_11/No.2

    Which atom has the same number of electrons as the hydroxide ion, OH^-?

    A   F   B   Ne   C   Na   D   Mg

3. June/2022/Paper_12/No.1

    Equations involving four enthalpy changes are shown.

    $$Na(g) \rightarrow Na^+(g) + e^- \qquad \Delta H = W$$
    $$Na(g) \rightarrow Na^{2+}(g) + 2e^- \qquad \Delta H = X$$
    $$Na(s) \rightarrow Na(g) \qquad \Delta H = Y$$
    $$Na(s) \rightarrow Na^{2+}(g) + 2e^- \qquad \Delta H = Z$$

    Which equation represents the second ionisation energy of sodium?

    A   X   B   X + Y – W   C   X – W   D   Z – W

4. June/2022/Paper_12/No.2

    This question refers to isolated gaseous atoms in the ground state.

    In which atom are all electrons paired?

    A   Ba   B   Br   C   S   D   Si

5. June/2022/Paper_12/No.6

Elements J and L are both in Group 15.

J and L each form a gaseous covalent hydride in which their oxidation number is –3.

In the liquefied forms of these hydrides, significant hydrogen bonding occurs only in the hydride of L.

Which row about J and L could be correct?

	identity of J	identity of L	outer shell electron configuration
A	As	N	p^5
B	As	N	s^2p^3
C	N	As	p^5
D	N	As	s^2p^3

6. June/2022/Paper_13/No.1

Which atom has exactly three unpaired electrons in the ground state?

A   an isolated gaseous aluminium atom

B   an isolated gaseous carbon atom

C   an isolated gaseous chromium atom

D   an isolated gaseous phosphorus atom

7. June/2022/Paper_13/No.2

Which element has the **second** smallest atomic radius in its group and the **second** highest electrical conductivity in its period?

A   boron

B   calcium

C   magnesium

D   sodium

8.

A sample of sulfur consists mostly of ^{32}S. It also contains 4.2% ^{34}S and 2.8% ^{36}S. No other isotopes of sulfur are present.

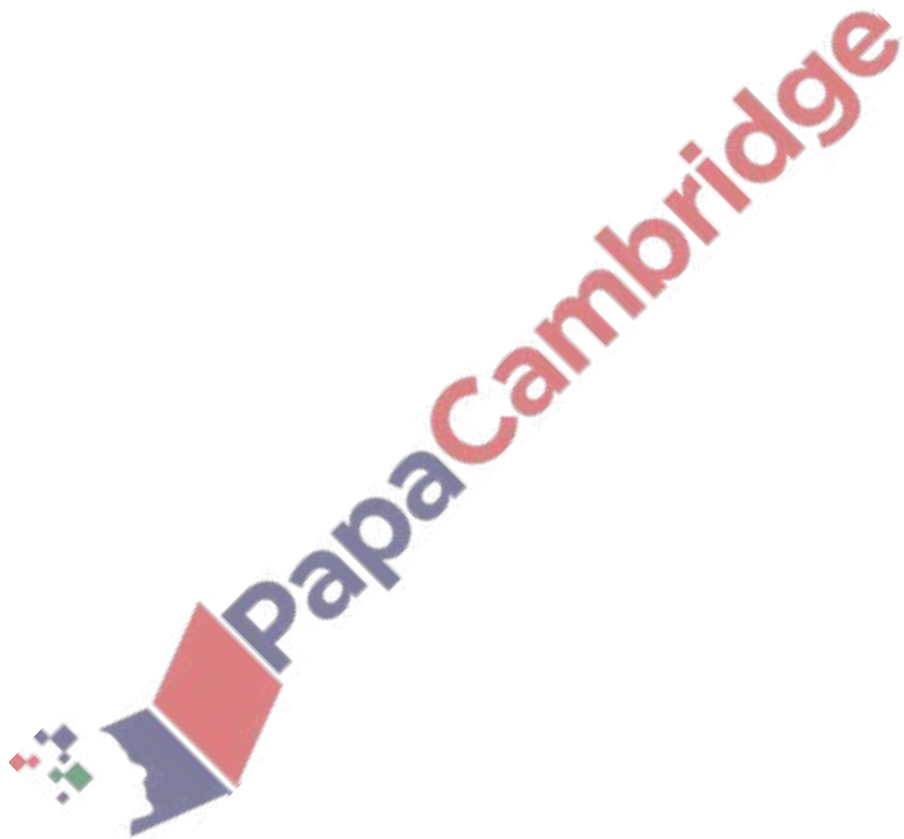What is the relative atomic mass, A_r, of **this** sample of sulfur?

A   32.1   **B**   32.2   **C**   34.0   **D**   34.3

(e) A sample of magnesium contains three isotopes, ^{25}Mg, ^{26}Mg and **X**.

The percentage abundance of the three isotopes is shown in Table 1.1.

Table 1.1

isotope of Mg	mass/a.m.u.	percentage abundance/%
X		78.99
^{25}Mg	24.99	10.00
^{26}Mg	25.98	11.01

(i) The relative atomic mass, A_r, is calculated by comparing the average mass of the isotopes of an element to the unified atomic mass unit.

Define the unified atomic mass unit.

.... [1]

(ii) Calculate the mass of **X**. Use data from Table 1.1 and A_r (magnesium) = 24.31 in your calculation. Show your working.

mass of **X** = ...
[2]

(iii) State **one** similarity and **one** difference in the properties of these isotopes of magnesium. Explain your answer.

....

....

.... [2]

(a) Define first ionisation energy.

....

....

.... [2]

(b) Successive ionisation energies for element **A** are shown in Table 1.1.

Table 1.1

ionisation	1st	2nd	3rd	4th	5th	6th	7th	8th
ionisation energy / kJ mol^{-1}	1310	3390	5320	7450	11 000	13 300	71 000	84 100

Use Table 1.1 to deduce the group of the Periodic Table that **A** belongs to. Explain your answer.

Group ....

....

[1]