Name.....

TEST 1 – ATOMIC STRUCTURE, MOLES AND THE PERIODIC TABLE **Total** /66 64

Section 1 – Multiple Choice Questions (22 marks in total)
Mark your selected answer with a '**X**'

1.	A	B	**X**	D	13.	**X**	B	C	D
2.	A	**X**	C	D	14.	A	**X**	C	D
3.	A	**X**	C	D	15.	A	**X**	C	D
4.	A	B	**X**	D	16.	A	**X**	C	D
5.	A	**X**	C	D	17.	A	B	C	**X**
6.	**X**	B	C	D	18.	A	B	**X**	D
7.	A	**X**	C	D	19.	**X**	B	C	D
8.	**X**	B	C	D	20.	**X**	B	C	D
9.	A	**X**	C	D	21.	A	B	C	**X**
10.	A	**X**	C	D	22.	A	B	C	**X**
11.	A	B	C	**X**	23.	A	**X**	C	D
12.	A	**X**	**X**	D	24.	A	**X**	**X**	D

CBBCBABABBDB ABBDDCAADDBC

Section 2 – Short Answer Questions

1. The terms uranium-235 and uranium-238 are often heard in discussions about nuclear power and nuclear weapons.

   a. State one feature that is the same for an atom of uranium-235 and an atom of uranium-238.

   same number of protons (92)

   b. State one feature that makes atoms of uranium-235 and uranium-238 different.

   different numbers of neutrons
   U-235 = 143
   U-238 = 146

   (2 marks)

2. What is the Molar Mass of:

a. Magnesium ? (1 mark)

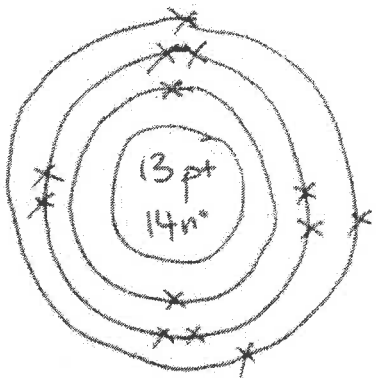
24.31 gmol^{-1}

b. Calcium Carbonate ($CaCO_3$) ? **Show all working for full marks** (3 marks)

M(Ca) = 40.08
M(C) = 12.01
M(O) = 16

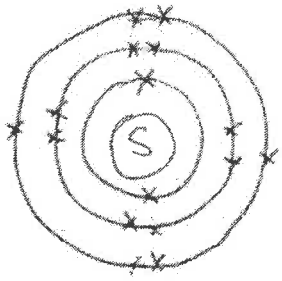
$M(CaCO_3) = M(Ca) + M(C) + [3\ M(O)]$
$= 40.08 + 12.01 + (3 \times 16)$
$= 100.09$ gmol^{-1}

3. In the space below, draw a diagram to represent an atom of Aluminium. Make sure you show the numbers of subatomic particles in the nucleus as well as the electron configuration. (3 marks)



protons + neutrons (1)
electrons (1)
neat + complete (1)

4. Draw electron shell diagram to represent the electron configuration of an atom of Sulfur. (2 marks)



For the following Questions 5 and 6 - be sure to **show all working for full marks.**

5. How many moles of:

a. Hydrogen atoms are there in 5.0 moles of H_2SO_4 ? (1 mark)

10 mol

b. Sodium is there in 64.2 g of Sodium metal? (2 marks)

$n(Na) = ?$

$m(Na) = 64.2g$

$M(Na) = 22.99$

$n = \frac{m}{M} = \frac{64.2}{22.99}$

$= 2.79$ mol

c. Carbon are in 200g of $CaCO_3$? (3 marks)

$n(C) = ?$

$M(CaCO_3) = 100.09$

$m(CaCO_3) = 200g$

$n(CaCO_3) = \frac{m}{M} = \frac{200}{100.09}$

$= 1.99$ mol

$n(C) = n(CaCO_3)$

$= 1.99$ mol

6. Determine the percentage composition of hydrated copper sulfate, $CuSO_4.5H_2O$. (5 marks)

$M(CuSO_4.5H_2O) = M(Cu) + M(S) + [9 \times M(O)] + [10 \times M(H)]$

$= 63.55 + 32.07 + [9 \times 16] + [10 \times 1.008]$

$= 249.7$ g mol^{-1}

$\%\ Cu \text{ in } CuSO_4.5H_2O = \frac{M(Cu)}{M(CuSO_4.5H_2O)} \times 100$

$= \frac{63.55}{249.7} \times 100$

$= 25.45\%$

$\%\ S = \frac{32.07}{249.7} = 12.84\%$

$\%\ O = \frac{(9 \times 16)}{249.7} = 57.69\%$

$\%\ H = \frac{10 \times 1.008}{249.7} = 4.04\%$

7. Define the following terms. (4 marks)

a. **ionisation energy**

the energy required to remove one electron from an atom of an element in the gas phase ✓ (2)

b. **electronegativity**

the ability of an atom to attract electrons in a covalent bond towards itself (1)

c. **isotope**

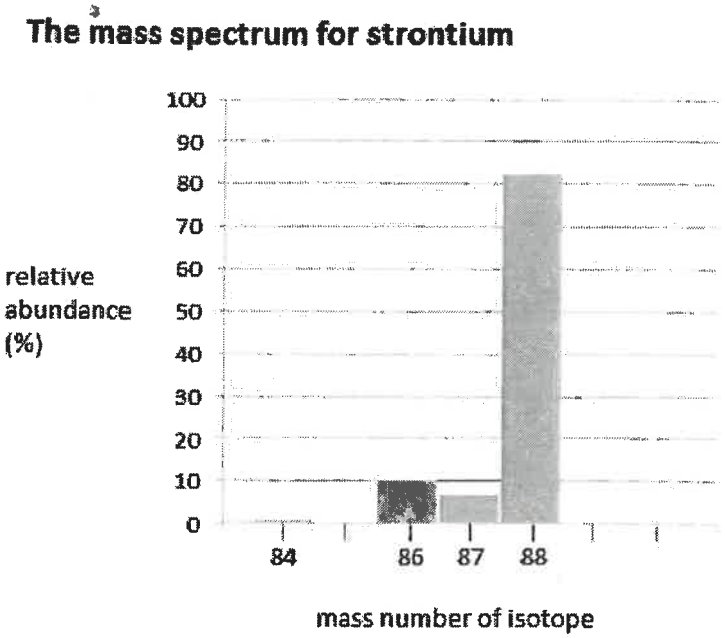
an atom of an element that has the same number of protons but different number(s) of neutrons (1)

d) ion: an atom that has lost or gained electrons and has an electric charge

8. Complete the following table. $-\frac{1}{2}$ for each incorrect (3 marks)

Element (neutral atoms)	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
^{9}Be	4	9	4	5	4
Selenium	34	79	34	45	34
Fluorine	9	19	9	10	9

9. The diagram below shows the mass spectrum for strontium.



a. How many isotopes does strontium have? 4 (1 mark)

b. Which isotope is most abundant? Sr - 88 (1 mark)

c. Calculate the relative atomic mass of strontium. (3 marks)

$A_r(Sr) = \frac{(7.Sr\text{-}84 \times 84) + (7.Sr\text{-}86 \times 86) + (7.Sr\text{-}87 \times 87) (7.Sr\text{-}88 \times 88)}{100}$

$= \frac{(1 \times 84) + (10 \times 86) + (7 \times 87) + (82 \times 88)}{100}$ (1)

$= \frac{84 + 860 + 609 + 7216}{100}$

$= \frac{[illegible]}{100}$

$= [illegible]$ amu (1)

67.69

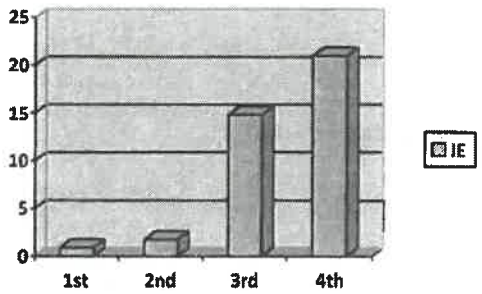
10. **Describe** the trend in atomic radius across a period (from left to right). (1 marks)

decreases

11. **Explain** the trend that atomic radius shows across the periodic table(from left to right). (3 marks)

Although the number of occupied electron shells stays constant (1) the core (nuclear) charge increases (1) so the electrons are attracted more strongly to the nucleus

12. The first four successive ionization energies for the element Beryllium are shown in the graph below:



(a) Explain why the ionization energy increases as each successive electron is removed from the beryllium atom. (1 mark)

Increase in Positive Charge
Because ~~electrons closer to the nucleus are more tightly held~~ with each e⁻ lost.
~~so~~ more energy is required to overcome the greater electrostatic attraction experienced by each electron

(b) Explain the dramatic increase in the third ionization energy of Berylium. (1 mark)

The third electron is in the innermost shell ∴ very close to nucleus.

END OF TEST