

Q1.

In a time of flight mass spectrometer, molecule X is ionised using electrospray ionisation.

What is the equation for this ionisation?

- A $X(l) + e^- \rightarrow X^+(g) + 2 e^-$
- B $X(g) + e^- \rightarrow X^+(g) + 2 e^-$
- C $X(l) + H^+ \rightarrow XH^+(g)$
- D $X(g) + H^+ \rightarrow XH^+(g)$

(Total 1 mark)

Q2.

What is the electron configuration of V^{2+} in the ground state?

- A $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
- B $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1 4s^2$
- C $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
- D $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

(Total 1 mark)

Q3.

Which atom has one more proton and two more neutrons than ${}_{15}^{31}\text{P}$?

- A ${}_{16}^{33}\text{P}$
- B ${}_{16}^{34}\text{P}$
- C ${}_{16}^{33}\text{S}$
- D ${}_{16}^{34}\text{S}$

(Total 1 mark)

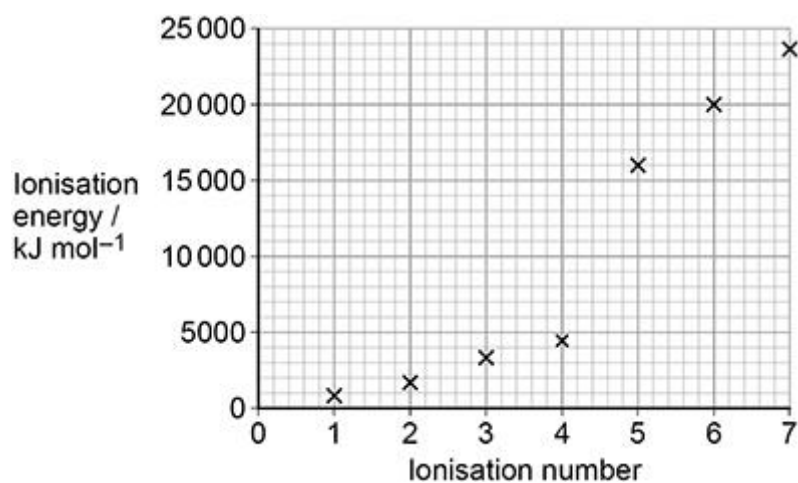
Q4.

Which element has a first ionisation energy lower than that of sulfur?

- A Chlorine
- B Oxygen
- C Phosphorus
- D Selenium

(Total 1 mark)**Q5.**

The first seven successive ionisation energies for element Z are shown.



What is element Z?

- A Carbon
- B Nitrogen
- C Silicon
- D Phosphorus

(Total 1 mark)

Q6.

Which has the electron configuration of a noble gas?

A H^+ B O^- C Se^{2-} D Zn^{2+}

(Total 1 mark)

Q7.

Which atom has the smallest number of neutrons?

A ^3H B ^4He C ^5He D ^4Li

(Total 1 mark)

Q8.Which is the electron configuration of an atom with **only two** unpaired electrons?A $1s^2 2s^2 2p^3$ B $1s^2 2s^2 2p^4$ C $1s^2 2s^2 2p^6 3s^2 3p^5$ D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

(Total 1 mark)

Q9.

Which shows the electron configuration of an atom of a transition metal?

A $[\text{Ar}] 4s^2 3d^0$ B $[\text{Ar}] 4s^2 3d^8$ C $[\text{Ar}] 4s^2 3d^{10}$ D $[\text{Ar}] 4s^2 3d^{10} 4p^1$

(Total 1 mark)

Q10.

Which atom has the greatest first ionisation energy?

- A H
- B He
- C Li
- D Ne

(Total 1 mark)

Q11.

A student has a 10 cm^3 sample of $1.00 \times 10^{-2} \text{ mol dm}^{-3}$ methanoic acid solution. The student is asked to dilute the methanoic acid solution to a concentration of $2.00 \times 10^{-4} \text{ mol dm}^{-3}$ by adding distilled water.

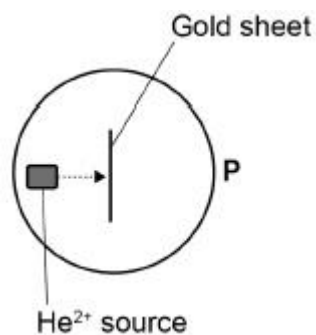
Which volume of water should be added?

- A 200 cm^3
- B 490 cm^3
- C 500 cm^3
- D 510 cm^3

(Total 1 mark)

Q12.

In the early twentieth century the apparatus shown in the diagram was used to investigate atomic structure. When He^{2+} particles were fired at a thin sheet of gold, most of the particles were detected at point **P**.



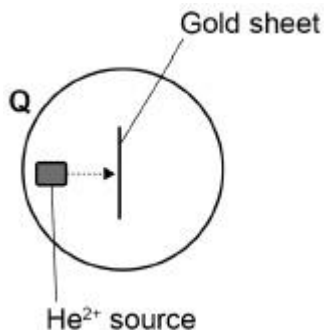
What conclusion can be drawn from the detection of He^{2+} particles at point **P**?

- A** Gold atoms contain electrons.
- B** Gold atoms contain protons.
- C** Gold atoms contain neutrons.
- D** Gold atoms are mainly empty space.

(Total 1 mark)

Q13.

When He^{2+} particles were fired at a thin sheet of gold, about 1 in 8000 of the particles were detected at point **Q**.



What conclusion can be drawn from the detection of He^{2+} particles at point **Q**?

- A** Gold atoms have a small, positive nucleus.
- B** Gold atoms have electrons in orbitals.
- C** Gold consists of ions in a sea of delocalised electrons.
- D** Gold atoms have more protons than He^{2+} particles.

(Total 1 mark)

Q14.

Which statement about time of flight mass spectrometry is correct?

- A** The current in the detector is proportional to the ion abundance
- B** Sample particles gain electrons to form positive ions
- C** Particles are detected in the order of their kinetic energies
- D** Ions are accelerated by a magnetic field

(Total 1 mark)

Q15.

Chlorine exists as two isotopes ^{35}Cl and ^{37}Cl in the ratio 3:1

Which statement about peaks in the mass spectrum of Cl_2 is correct?

- A** Peaks at $m/z = 70$ and 74 in the ratio 3:1
- B** Peaks at $m/z = 70, 72$ and 74 in the ratio 9:6:1
- C** Peaks at $m/z = 70, 72$ and 74 in the ratio 9:3:1
- D** Peaks at $m/z = 70$ and 72 in the ratio 3:1

(Total 1 mark)

Q16.

Element Q forms a sulfate with formula QSO_4

Which of these could represent the electronic configuration of an atom of Q?

- A** $[\text{Ne}]3s^1$
- B** $[\text{Ne}]3s^2$
- C** $[\text{Ne}]3s^23p^1$
- D** $[\text{Ne}]3s^13p^2$

(Total 1 mark)

Q17.

Which of these has the highest first ionisation energy?

- A** Na
- B** Al
- C** Si
- D** Cl

(Total 1 mark)

Q18.

Which of these correctly shows the numbers of sub-atomic particles in a $^{41}\text{K}^+$ ion?

	Number of electrons	Number of protons	Number of neutrons	
A	19	19	20	<input type="checkbox"/>
B	18	20	21	<input type="checkbox"/>
C	18	19	22	<input type="checkbox"/>
D	19	18	23	<input type="checkbox"/>

(Total 1 mark)**Q19.**

Bromine exists as two isotopes ^{79}Br and ^{81}Br , which are found in almost equal abundance.

Which of the statements is correct?

- A The first ionisation energy of ^{79}Br is less than the first ionisation energy of ^{81}Br
- B The atomic radius of ^{79}Br is less than the atomic radius of ^{81}Br
- C The mass spectrum of $\text{C}_3\text{H}_7\text{Br}$ has two molecular ion peaks at 122 and 124
- D ^{79}Br is more reactive than ^{81}Br

(Total 1 mark)**Q20.**

Which species has the same number of electrons as the radical $\cdot\text{CH}_3$?

- A CH_2
- B CH_3^+
- C CH_3^-
- D CH_4^+

(Total 1 mark)

Q21.

What are the numbers of neutrons and electrons in the $^{57}\text{Fe}^{2+}$ ion?

	Neutrons	Electrons	
A	31	24	<input type="checkbox"/>
B	57	24	<input type="checkbox"/>
C	31	26	<input type="checkbox"/>
D	57	28	<input type="checkbox"/>

(Total 1 mark)

Q22.

What is the electron configuration of Cu^{2+} ?

- A $[\text{Ar}]3\text{d}^94\text{s}^2$
- B $[\text{Ar}]3\text{d}^{10}4\text{s}^1$
- C $[\text{Ar}]3\text{d}^9$
- D $[\text{Ar}]3\text{d}^{10}$

(Total 1 mark)

Q23.

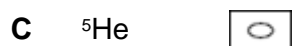
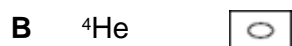
Which of these atoms has the largest atomic radius?

- A Ar
- B Cl
- C Mg
- D Na

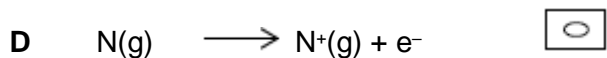
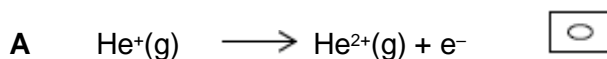
(Total 1 mark)

Q24.

Which of these atoms has the smallest number of neutrons?

**(Total 1 mark)****Q25.**

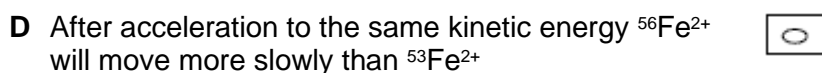
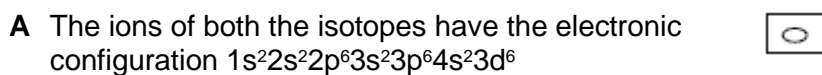
Which change requires the largest amount of energy?

**(Total 1 mark)****Q26.**

Ions of two isotopes of iron are

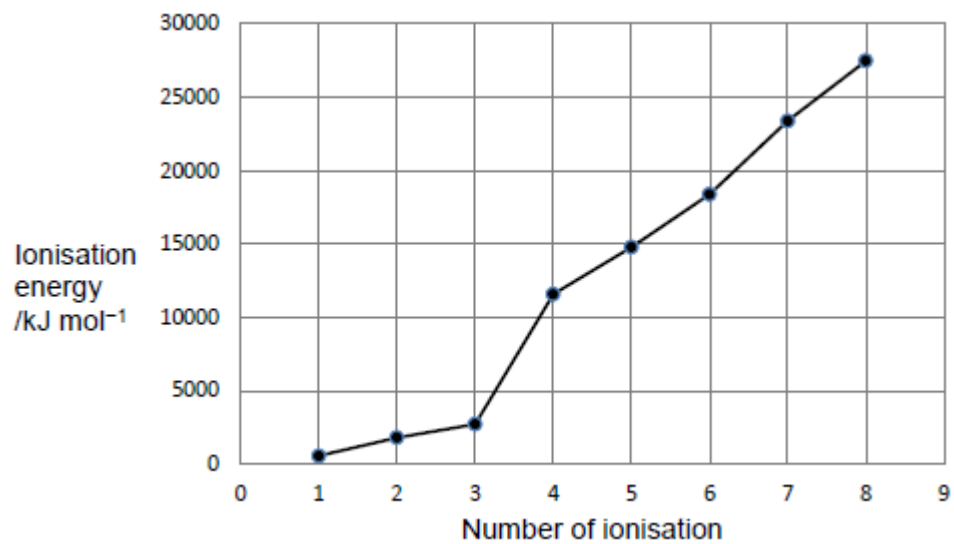


Which statement is correct?

**(Total 1 mark)**

Q27.

The successive ionisation energies for element X are shown in the following graph.



Which element is X?

- A Nitrogen
- B Phosphorus
- C Aluminium
- D Boron

(Total 1 mark)