

HL Atomic Structure Multiple-Choice Questions

1. Which row is correct for the relative masses of subatomic particles?

	Particle	Relative mass		Particle	Relative mass
A	Electron	1		Proton	1/2000
B	Proton	1		Neutron	1
C	Neutron	1/2000		Proton	1
D	Electron	1		Neutron	1/2000

2. What is the number of protons present in a $^{58}\text{Co}^{2+}$ ion?

- A 58 B 31 C 29 D 27

3. What is the number of electrons present in a $^{79}\text{Se}^{2-}$ ion?

- A 79 B 34 C 36 D 32

4. What is the number of neutrons present in a $^{238}\text{U}^{3+}$ ion?

- A 146 B 92 C 143 D 238

5. Which of the following condensed electron configurations is **not** correct?

- A Mg: $[\text{Ne}] 3s^2$ B Fe: $[\text{Ar}] 3d^6$
 C Cu: $[\text{Ar}] 4s^1 3d^{10}$ D Br: $[\text{Ar}] 3d^{10} 4s^2 4p^5$

6. The condensed electron configuration for $_{24}\text{Cr}$ is

- A $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$ B $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$
 C $[\text{Ar}] 4s^2 3d^4$ D $[\text{Ar}] 4s^1 3d^5$

7. In the emission spectrum of deuterium the frequency of the convergence limit in the series where the electron falls down to $n=1$ is 3.29×10^{15} Hz. The value of Planck's constant is 6.63×10^{-34} Js. The ionization energy of deuterium in kJ mol^{-1} is given by. $E=h\nu$

- A $\frac{3.29 \times 10^{15} \times 6.63 \times 10^{-34}}{6.02 \times 10^{23} \times 1000}$
 B $\frac{3.29 \times 10^{15} \times 6.63 \times 10^{-34} \times 6.02 \times 10^{23}}{1000}$
 C $\frac{6.63 \times 10^{-34}}{3.29 \times 10^{15} \times 6.02 \times 10^{23} \times 1000}$
 D $\frac{3.29 \times 10^{15} \times 6.63 \times 10^{-34} \times 1000}{6.02 \times 10^{23}}$

8. Which of the following is an f-block element and a lanthanoid?

- A Uranium B Europium
 C Hafnium D Rutherfordium

9. Which of the following is the symbol of a d block element?

- A C B Co C Cf D Ce

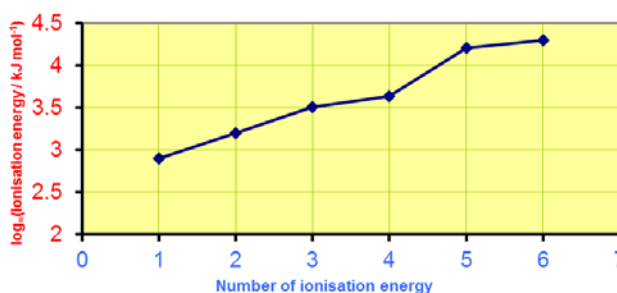
10. The condensed electron configuration for a copper atom is:

- A $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$ B $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^1$
 C $[\text{Ar}] 4s^2 3d^9$ D $[\text{Ar}] 4s^1 3d^{10}$

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11. Which of the following atoms does not contain any unpaired electrons?
 A F B Mg C Na D O
12. Which of the following is correct?
 A The first ionization energy of B is higher than that of Be
 B The second ionization energy of Mg is lower than the first ionization energy of Na
 C The first ionization energy of N is higher than the first ionization energy of O
 D The fourth ionization energy of Al is lower than the fourth ionization energy of Si
13. What is the electron configuration of Cu^{2+} ?
 A $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$ B $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
 C $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^8$ D $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
14. Rhenium has two naturally occurring isotopes, ^{185}Re and ^{187}Re . The relative atomic mass of Rhenium is 186.2. What are the natural abundances of these isotopes?
 A 40 % ^{185}Re and 60 % ^{187}Re B 60 % ^{185}Re and 40 % ^{187}Re
 C 12 % ^{185}Re and 88 % ^{187}Re D 88 % ^{185}Re and 12 % ^{187}Re
15. Which of the following would produce a line in the visible emission spectrum of hydrogen:
 A A photon is emitted as an electron falls from outside the atom to the level with $n=1$
 B A photon is absorbed as an electron is promoted from level $n=1$ to level $n=2$
 C A photon is emitted as an electron falls from level $n=5$ to level $n=2$
 D A photon is emitted as an electron falls from level $n=7$ to level $n=3$
16. Which of the following transitions in a hydrogen atom would produce a line of the highest frequency in the emission spectrum?
 A $n=5 \rightarrow n=4$ B $n=4 \rightarrow n=3$ C $n=3 \rightarrow n=2$ D $n=2 \rightarrow n=1$
17. Which of the following electronic transitions in a hydrogen atom would produce a line of the shortest wavelength in the emission spectrum?
 A $n=7 \rightarrow n=2$ B $n=9 \rightarrow n=3$ C $n=2 \rightarrow n=1$ D $n=5 \rightarrow n=2$

18. The graph shows \log_{10} (ionisation energy) for the removal of the first 6 electrons from an element.



The element could be

- A Si B Al C N D K
19. Which of the following statements about first ionisation energy is not correct?
 A First ionisation energy increases across regularly across Period 2
 B First ionisation energy decreases down Group 17
 C Helium has a higher first ionisation energy than hydrogen
 D The first ionisation energy of oxygen is higher than that of sulfur

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20. Which of the following statements is correct
- A The maximum number of electrons in the 3d subshell is 6
 - B The maximum number of electrons in the 5f subshell is 14
 - C The maximum number of electrons in the 5th shell is 32
 - D It is not possible for an atom to have more electrons in p orbitals than in d orbitals

21. Which of the following atoms/ions does **not** have exactly 2 unpaired electrons?

A S B Ni²⁺ C Cr³⁺ D Ti²⁺

22. A line in the emission spectrum of magnesium has wavelength 0.313 μm. The energy of the photon (in J) emitted is given by: *[c=νλ and E=hν]*

- A $E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{0.313}$
- B $E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{3.13 \times 10^{-6}}$
- C $E = 6.63 \times 10^{-34} \times 3.13 \times 10^{-10}$
- D $E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{3.13 \times 10^{-7}}$

23. The first ionisation energies of 4 successive elements in the periodic table are:

736 kJ mol⁻¹ 577 kJ mol⁻¹ 786 kJ mol⁻¹ 1060 kJ mol⁻¹

These elements could be:

A Na, Mg, Al, Si B Mg, Al, Si, P C S, Cl, Ar, K D Si, P, S, Cl

24. The first 7 successive ionisation energies for an element are:

	Ionisation energy / kJ mol ⁻¹
1	966
2	1950
3	2730
4	4850
5	6020
6	12300
7	15400

The element is:

A Ga B Ge C As D Se

25. Which of the following orbital diagrams is correct for an atom with electron configuration 3d³ in its ground state?

- A

↑↓	↑			
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- B

↑		↑		↑
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- C

↑	↓	↑		
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- D

↑	↓	↓		
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