IB Chemistry HL - S3.1

The periodic table: Classification of elements

Exercises + Practice questions

Official answers appended at the end

Exercise

Q1. What increases **in equal steps of one** from left to right in the periodic table for the elements sodium to argon?

A the relative atomic mass

B the number of occupied electron energy levels

C the number of neutrons in the most common isotope

D the number of electrons in the atom

Q2. Which of the following elements is a metalloid?

A calcium **B** manganese **C** germanium **D** carbon

Q3. Which of the following materials is the best conductor of electricity in the solid state?

A silicon **B** graphite **C** phosphorus **D** antimony

Q4. Use the IB periodic table to identify the position of the following elements.

	Element	Period	Group
(a)	helium		
(b)	chlorine		
(c)	barium		
(d)	francium		

Q7. Which of the following properties is used to arrange the elements in the modern periodic table?

A relative atomic mass

B number of valence electrons

C atomic number

D effective nuclear charge

Q8. The only isotope of oganesson to be synthesized is $^{294}_{118}Og$ with a half-life of 700 μs. Which of the following statements is correct?

I. The nucleus of the atom has a relative charge of +118.

II. Og has the outer electron configuration $7p^6$.

III. Oganesson is a stable element.

A I and II only

B I and III only

C II and III only

D I, II and III

Q9. Mendeleev left a space in his table for the element now known as gallium. He was able to predict many properties for the then unknown element.

(a) The densities of some group 13 elements are shown in the table.

Atomic number	Element	Density / g cm^{-3}
5	boron	2.34
13	aluminium	2.70
31	gallium	
49	indium	7.30
81	thallium	11.85

Plot a graph of density against atomic number to predict the density of gallium.

Exercise

Q10. Which properties of the period 3 elements increase from sodium to argon?

A nuclear charge and atomic radius

B atomic radius and electronegativity

C nuclear charge and electronegativity

D nuclear charge, atomic radius, and electronegativity

Q11. Which of the following are properties of gaseous atoms?

I. ionization energy
II. electron affinity
III. electronegativity

A I and II **B** I and III **C** II and III **D** I, II and III

Q12. Which of the following changes are endothermic?

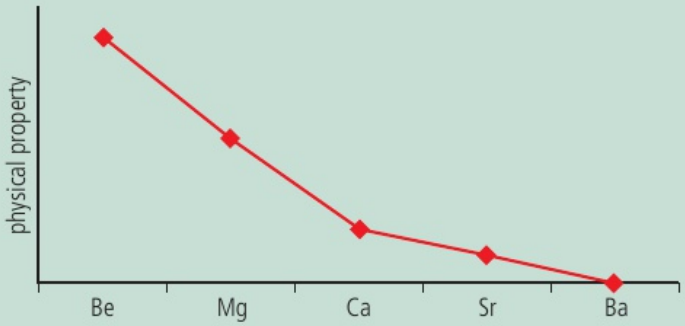
I. $Ca(g) \rightarrow Ca^{+}(g) + e^{-}$
II. $I(g) + e^{-} \rightarrow I^{-}(g)$
III. $O^{-} + e^{-} \rightarrow O^{2-}(g)$

A I and II **B** I and III **C** II and III **D** I, II and III

Q13. Identify the element which is likely to have an electronegativity value most similar to that of sodium.

A beryllium **B** calcium **C** magnesium **D** hydrogen

Q14. The graph represents the variation of a property of the group 2 elements.



Identify the property.

A ionic radius

B atomic radius

C neutron/proton ratio

D first ionization energy

Q15. Which physical property generally increases down a group but decreases from left to right across a period?

A electron affinity

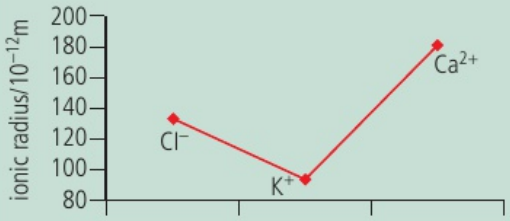
B electronegativity

C ionization energy

D atomic radius

Q16 Identify the graph which shows the correct ionic radii for the isoelectronic ions Cl^-, K^+, and Ca^{2+}.

A



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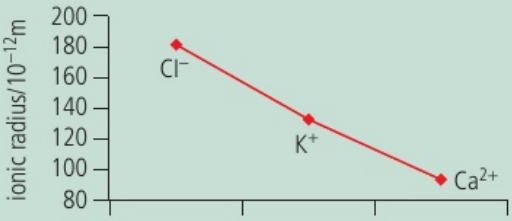

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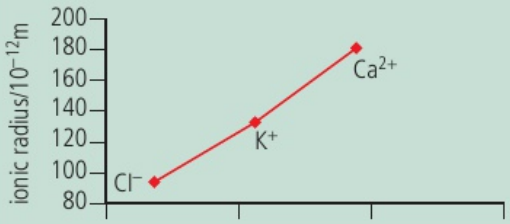

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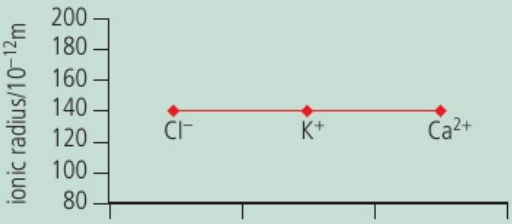

Q17. **(a)** Explain what is meant by the atomic radius of an element.

(b) The atomic radii of the elements are given in Section 10 of the data booklet.

(i) Explain why no values for atomic radii are given for the noble gases.

(ii) Describe and explain the trend in atomic radii across the period 3 elements.

Q18. Si^{4+} has an ionic radius of 4.2×10^{-11} m and Si^{4-} has an ionic radius of 2.71×10^{-10} m.

Explain the large difference in size between the Si^{4+} and Si^{4-} ions.

Q19. Atomic radii and ionic radii are given in the data booklet.

Explain why:

(a) the potassium ion is much smaller than the potassium atom.

(b) there is a large increase in ionic radius from silicon (Si^{4+}) to phosphorus (P^{3-}).

(c) the ionic radius of Na^+ is less than that of F^-.

Q20. What is the order of decreasing radii for the species Cl, Cl^+, and Cl^-?