

Name \_\_\_\_\_

Practice Exam: Paper 1

Topic 3: Periodicity

SL

SL Score

/23

HL Score

/35

Key

- Which property generally **decreases** across period 3?
  - Atomic number
  - Electronegativity
  - Atomic radius
  - First ionization energy
  
- Which property **increases** down group 1?
  - First ionization energy
  - Melting point
  - Reactivity
  - Electronegativity
  
- Which statement about the elements in group 7 is correct?
  - $\text{Br}_2$  will oxidize  $\text{Cl}^-$ .
  - $\text{F}_2$  has the least tendency to be reduced.
  - $\text{Cl}_2$  will oxidize  $\text{I}^-$ .
  - $\text{I}_2$  is a stronger oxidizing agent than  $\text{F}_2$ .
  
- Which change explains why the boiling points of the halogens increase as their molecular masses increase?
  - The intermolecular attraction due to temporarily induced dipoles increases.
  - The gravitational attraction between molecules increases.
  - The polarity of the bond within the molecule increases.
  - The strength of the bond within the molecule increases.

5. Which pair of elements has the greatest difference in electronegativity?

- A. Cs and F
- B. Cs and Cl
- C. Cs and Br
- D. Cs and I

6. Which statements about the periodic table are correct?

- I. Elements in period 3 have similar chemical properties.
- II. Elements in group 7 show a gradual change in physical properties.
- III. The position of an element in period 3 is related to the number of electrons in the highest occupied energy level.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

7. Which statements about period 3 are correct?

- I. The electronegativity of the elements increases across period 3.
- II. The atomic radii of the elements decreases across period 3.
- III. The oxides of the elements change from acidic to basic across period 3.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

8. Which property **decreases** down group 7 in the periodic table?

- A. Melting point
- B. Electronegativity
- C. Atomic radius
- D. Ionic radius

9 Which oxides produce an acidic solution when added to water?

I.  $\text{P}_4\text{O}_{10}$

II.  $\text{MgO}$

III.  $\text{SO}_3$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

10. Which ion has the largest radius?

A.  $\text{Cl}^-$

B.  $\text{K}^+$

C.  $\text{Br}^-$

D.  $\text{F}^-$

11. Which properties of the alkali metals decrease going down group 1?

A. First ionization energy and reactivity

B. Melting point and atomic radius

C. Reactivity and electronegativity

D. First ionization energy and melting point

12. Which statements about the periodic table are correct?

I. The elements Mg, Ca and Sr have similar chemical properties.

II. Elements in the same period have the same number of main energy levels.

III. The oxides of Na, Mg and P are basic.

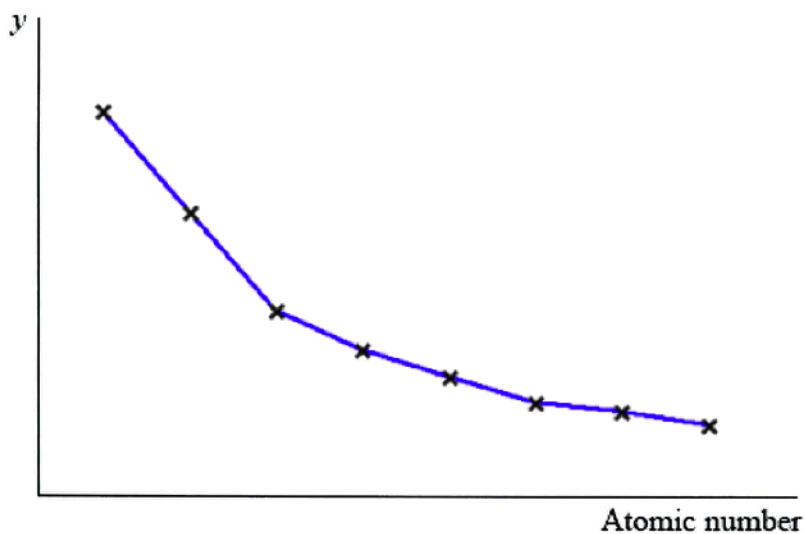
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

13. The  $x$ -axis of the graph below represents the atomic number of the elements in period 3.



Which variable could represent the  $y$ -axis?

- A. Melting point  
B. Electronegativity  
C. Ionic radius  
 D. Atomic radius
14. How many protons, neutrons and electrons are present in each atom of  $^{31}\text{P}$ ?

	Protons	Neutrons	Electrons
A.	16	15	16
<input checked="" type="radio"/> B.	15	16	15
C.	15	31	15
D.	16	31	16

15. An element is in group 4 and period 3 of the periodic table. How many electrons are in the highest occupied energy level of an atom of this element?
- A. 3  
 B. 4  
C. 12  
D. 14

16. Which is the best definition of *electronegativity*?
- A. Electronegativity is the energy required for a gaseous atom to gain an electron.
  - B. Electronegativity is the attraction of an atom for a bonding pair of electrons.
  - C. Electronegativity is the attraction between the nucleus and the valence electrons of an atom.
  - D. Electronegativity is the ability of an atom to attract electrons from another atom.
17. Which statement describes the trends of electronegativity values in the periodic table?
- A. Values increase from left to right across a period and increase down a group.
  - B. Values increase from left to right across a period and decrease down a group.
  - C. Values decrease from left to right across a period and increase down a group.
  - D. Values decrease from left to right across a period and decrease down a group.
18. Which statement is correct for all elements in the same period?
- A. They have the same number of electrons in the highest occupied energy level.
  - B. They have the same chemical reactivity.
  - C. They have the same number of occupied energy levels.
  - D. They have the same number of neutrons.
19. Which equation best represents the first ionization energy of magnesium?
- A.  $\text{Mg(s)} \rightarrow \text{Mg}^{\text{+}}(\text{s}) + \text{e}^{-}$
  - C.  $\text{Mg(g)} \rightarrow \text{Mg}^{\text{+}}(\text{g}) + \text{e}^{-}$
  - B.  $\text{Mg(g)} \rightarrow \text{Mg}^{\text{2+}}(\text{g}) + 2\text{e}^{-}$
  - D.  $\text{Mg(s)} \rightarrow \text{Mg}^{\text{+}}(\text{g}) + \text{e}^{-}$
20. What happens when sodium is added to water?
- I. A gas is evolved
  - II. The temperature of the water increases
  - III. A clear, colourless solution is formed
- A. I and II only
  - C. II and III only
  - B. I and III only
  - D. I, II and III

21. An atom of an element contains 19 electrons. In which group of the periodic table does it occur?

- A. 1
- B. 2
- C. 5
- D. 7

22. Which species has the largest radius?

- A.  $\text{Cl}^-$
- B. K
- C.  $\text{Na}^+$
- D.  $\text{K}^+$

23. Which series is arranged in order of **increasing** radius?

- A.  $\text{Ca}^{2+} < \text{Cl}^- < \text{K}^+$
- B.  $\text{K}^+ < \text{Ca}^{2+} < \text{Cl}^-$
- C.  $\text{Ca}^{2+} < \text{K}^+ < \text{Cl}^-$
- D.  $\text{Cl}^- < \text{K}^+ < \text{Ca}^{2+}$

# HL

1. Which electron transitions are responsible for the colours of transition metal compounds?
- A. Between d orbitals and s orbitals
  - B. Among the attached ligands
  - C. From the metal ion to the attached ligands
  - D. Between d orbitals
2. Ligands can form dative covalent bonds with metal ions to form complex ions. Which of the following can act as a ligand?
- I.  $\text{Cl}^-$
  - II.  $\text{NH}_3$
  - III.  $\text{H}_2\text{O}$
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
3. Which metal nitrate solution is coloured?
- A.  $\text{Zn}(\text{NO}_3)_2(\text{aq})$
  - B.  $\text{Ni}(\text{NO}_3)_2(\text{aq})$
  - C.  $\text{Mg}(\text{NO}_3)_2(\text{aq})$
  - D.  $\text{Sc}(\text{NO}_3)_3(\text{aq})$
4. Which statements are correct for the complex ion  $[\text{CuCl}_4]^{2-}$ ?
- I. The oxidation number of Cu in the complex ion is +2.
  - II. The coordination number of the copper ion is 4.
  - III. Chloride ions are behaving as ligands.
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

5. What is the ligand in the complex  $K_3[Fe(CN)_6]$ ?

- A.  $CN^-$
- B.  $Fe^{3+}$
- C.  $K^+$
- D.  $[Fe(CN)_6]^{3-}$

6. In which complexes does iron have an oxidation number of +3?

- I.  $[Fe(H_2O)_6]^{3+}$
- II.  $[Fe(H_2O)_5(CN)]^{2+}$
- III.  $[Fe(CN)_6]^{3-}$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

7. Which statements are correct for the reaction of  $Cl_2$ ,  $MgCl_2$  and  $SiCl_4$  with water?

	$Cl_2$	$MgCl_2$	$SiCl_4$
A.	forms a neutral solution	forms a neutral solution	no reaction
<input checked="" type="radio"/> B.	forms an acidic solution	forms an acidic solution	forms an acidic solution
C.	forms an acidic solution	forms an acidic solution	no reaction
D.	forms a neutral solution	forms a neutral solution	forms an acidic solution

8. Which transition element, or compound of a transition element, is used as a catalyst in the Contact process?

- A. Fe
- B.  $MnO_2$
- C.  $V_2O_5$
- D. Ni



9. What are the products of the reaction between chlorine and water?
- A.  $O_2$ ,  $H_2$  and  $HCl$
- B.  $H_2$  and  $OCl_2$
- C.  $HCl$  and  $HOCl$
- D.  $HOCl$ ,  $H_2$  and  $Cl_2$
10. Which process is responsible for the colour of a transition metal complex?
- A. The absorption of light when electrons move between s orbitals and d orbitals
- B. The emission of light when electrons move between s orbitals and d orbitals
- C. The absorption of light when electrons move between different d orbitals
- D. The emission of light when electrons move between different d orbitals
11. Which salts form coloured solutions when dissolved in water?
- I.  $FeCl_3$
- II.  $NiCl_2$
- III.  $ZnCl_2$
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III
12. Which combination is correct for the complex ion in  $[Co(NH_3)_4(H_2O)Cl]Br$ ?

	Oxidation state of cobalt	Shape of the complex ion	Overall charge of the complex ion
A.	+2	Octahedral	+2
B.	+3	Octahedral	-1
<input checked="" type="radio"/> C.	+2	Octahedral	+1
D.	+2	Tetrahedral	+1