Chemistry Unit (Chapter 4, 5, 6, 7) Review

Vocabulary

Acids  Atomic-number  Atoms
Bases  Beta-particle  Bohr-diagrams
Bromothymol-blue  Catalyst  Combustion
Compounds  Concentration  Conservation of mass
Covalent bonding  Decomposition  Electron
Inorganic  Ionic bonding  Ions
Lewis diagrams  Litmus paper  Lone-pair
Mass-number  Methyl orange  Molecules
Neutralization (acid-base)  Neutron  Organic
Phenolphthalein  Polyatomic  Proton
Salts  Single and double replacement  Surface area
Synthesis  Unpaired electrons  Valence electron

Knowledge, understanding and skills with references to the learning goals

1. I can demonstrate knowledge of the three subatomic particles, their properties, and their location within the atom (e.g., by creating models)

Know the charges, relative masses and locations of the three sub atomic particles

<table>
<thead>
<tr>
<th>Name</th>
<th>Charge</th>
<th>Location</th>
<th>Relative Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>O2-</td>
<td>8</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Fe</td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>34</td>
</tr>
</tbody>
</table>

More practice? Reading Check p. 171

Be able to identify the atom or ion based on the number of protons and electron

a. | Atom or ion | Atomic number | # of protons | # of electron |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>O2-</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

b. More practice? CYU Q. 7 p. 183 Identify Ionic(metal and non-metal) and covalent compounds (metal and non-metal)

2. I can define and give examples of ionic bonding and covalent bonding

a. Identify the following compounds as ionic or covalent:
   - LiF, CaCO3, Cl2, NH3, Fe2O3, CF4
b. More practice? Practice problems #1 p. 197
3. I can with reference to elements 1 to 20 on the periodic table, draw and interpret Bohr models, including protons, neutrons, and electrons, of atoms, ions, molecules - covalent bonding, and ionic compounds.

Be able to draw and interpret Bohr Models for atoms, ions and molecules

a. Draw the Bohr Model for B, Al$^{3+}$, H$_2$O and NaF


5. I can draw and interpret Lewis diagrams showing single bonds for ionic compounds and covalent molecules

Be able to draw and interpret Lewis structures of compounds

a. Draw the Lewis structure of covalent HF and ionic NaF

b. More practice? CYU Q. 14 p. 183

7. I can use the periodic table and a list of ions (including polyatomic ions) to name and write chemical formulae for common ionic compounds, using appropriate terminology

Write the name or formula of the following ionic compounds

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe(OH)</td>
<td>magnesium(II) hydroxide</td>
</tr>
<tr>
<td>Na$_3$PO</td>
<td>magnesium(II) nitrate</td>
</tr>
<tr>
<td>PBF$_4$</td>
<td>aluminium phosphide</td>
</tr>
<tr>
<td></td>
<td>sodium bromide</td>
</tr>
</tbody>
</table>

8. I can convert names to formulae and formulae to names for covalent compounds, using prefixes up to “deca”

Write the name or formula of the following covalent compounds

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO$_2$</td>
<td>dinitrogen trioxide</td>
</tr>
<tr>
<td>OCI$_2$</td>
<td>diphosphorus tetrafluoride</td>
</tr>
</tbody>
</table>

More Practice? CYU Q. 7, 9 and 11 p. 201
11. I can write and balance (using the lowest whole number coefficients) chemical equations from formulae, word equations, or descriptions of experiments

Write and balance chemical equations
a. Balance the following equations
   \[ \underline{\text{CH}_4} + \underline{\text{O}_2} \rightarrow \underline{\text{CO}_2} + \underline{\text{H}_2\text{O}} \]
   \[ \underline{\text{AlCl}_3} \rightarrow \underline{\text{Al}} + \underline{\text{Cl}_2} \]
b. Write and balance the following equations
   calcium nitrate + potassium carbonate \( \rightarrow \) potassium nitrate + calcium carbonate
   nitrogen monoxide + oxygen \( \rightarrow \) nitrogen dioxide
c. Remember the seven diatomic elements when writing chemical formulas:
d. More practice? Practice problems p. 211

| 1. I can differentiate between acids and bases with respect to chemical formulae and properties |
| 5. I can recognize salts with respect to chemical formulae and properties |

Be able to identify an acid, a base and a salt based on characteristics, name and formula
a. Give an example of two acids, two bases and two salts (give formula and name)

| 2. I can explain the significance of the pH scale, with reference to common substances |
| 6. I can identify acids and bases using indicators |

b. What is the pH of an acid? A base? Give an example of each.

c. Colour the scales below

<table>
<thead>
<tr>
<th>1  2  3  4  5  6  7  8  9 10 11 12 13 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl orange</td>
</tr>
<tr>
<td>Bromothymol blue</td>
</tr>
<tr>
<td>Litmus</td>
</tr>
<tr>
<td>Phenolphthalein</td>
</tr>
<tr>
<td>Indigo carmine</td>
</tr>
</tbody>
</table>

d. More Practice? CYU Q. 1-6 p. 233
4. I can recognize the names and formulae of common acids

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂CO</td>
<td>sulfuric acid</td>
</tr>
<tr>
<td>H₂SO</td>
<td>hydrogen chloride</td>
</tr>
</tbody>
</table>

6. I can recognize metal and non-metal oxides and describe their reaction with water

Know common reactions involving acids, bases and salts (no so important)

a. Acid + base → salt + water
b. Metal oxide + water → base
c. Non-metal oxide + water → acid
d. Acid + metal → salt + hydrogen gas
e. More practice? CYU Q. 10 p. 243

7. I can define and give examples organic compounds and inorganic compounds

Be able to identify organic and inorganic compounds

a. Identify the following molecules as organic or inorganic
   C₅H₁₂, Na₂CO₃, C₆H₁₂O₆, CO₂, CH₃NH₂

b. More Practice? CYU Q. 4, 11 p. 251

1. I can identify, give evidence for, predict products of, and classify the following types of chemical reactions: synthesis (combination), decomposition, single and double replacement, neutralization (acid-base), combustion

a. Identify the following reactions as combustion, synthesis, decomposition, single or double replacement
   i. CO₂ → C + O₂
   ii. Au(NO₃)₃ + Ag → Au + 3AgNO₃
   iii. 2Li + 3N₂ → 2Li₃N
   iv. FeBr₂ + ZnSO₄ → ZnBr₂ + FeSO₄
b. Complete and balance the following chemical reactions
   i. Fe₂O₃ →
   ii. Al + NiBr₂ →
   iii. Cl₂ + NiBr₂ →
   iv. C₁₈H₃₈ + O₂ →
c. More practice? CYU Q. 1, 5 p. 271
2. I can explain how factors such as temperature, concentration, presence of a catalyst, and surface area can affect the rate of chemical reactions

   a. Identify which of the four factors is effecting the reaction rate in the following examples
      i. Extra dish soap is added to help wash of a greasy pan
      ii. Firewood is chopped to help start a fire
      iii. A lighted match is brought near a candle to light it
      iv. The reaction of oxygen and sucrose in human cells takes place in the presence of an enzyme.


Radioactivity

Vocabulary

<table>
<thead>
<tr>
<th>Alpha–particle</th>
<th>Beta–particle</th>
<th>Fission</th>
<th>Fusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma radiation</td>
<td>Half–life</td>
<td>Isotope</td>
<td>Radioactive decay</td>
</tr>
</tbody>
</table>

Knowledge, understanding and skills

1. I can define isotope in terms of atomic number and mass number, recognizing how these are communicated in standard atomic notation

   a. Complete the table below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Standard atomic notation</th>
<th>Number of Protons</th>
<th>Number of Neutron</th>
<th>Mass Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead-206</td>
<td></td>
<td>19</td>
<td>21</td>
<td>13</td>
</tr>
</tbody>
</table>


2. I can relate radioactive decay (e.g., alpha, beta, gamma) to changes in the nucleus

3. I can relate the following subatomic particles to radioactive decay: proton, neutron, electron, alpha particle, and beta particle

   a. Identify the following as alpha, beta or gamma decay

   \[ ^{131}\text{I} \rightarrow ^{131}\text{Xe} + ^0\beta \]
   \[ ^{226}\text{Ra} \rightarrow ^{222}\text{Rn} + ^4\alpha \]
   \[ ^{60}\text{Ni}^* \rightarrow ^{60}\text{Ni} + ^0\gamma \]
The symbol 

\[ _{1}^{131}I \rightarrow _{52}^{131}Xe + _{-1}^{0}e \]

\[ _{91}^{231}Pa \rightarrow _{89}^{227}Ac + _{2}^{4}He \]

4. I can complete and balance nuclear equations to illustrate radioactive decay

(a) Complete the following and identify them as alpha, beta, gamma, fusion or fission:

\[ _{0}^{1}n + _{92}^{235}U \rightarrow _{54}^{143}Xe + _{38}^{90}Sr + _{0}^{1}n \]

\[ _{1}^{2}H + _{1}^{2}H \rightarrow _{2}^{3}He + ____ \]

\[ _{0}^{1}n + ____ \rightarrow _{52}^{137}Te + _{42}^{100}Mo + _{0}^{3}n \]

\[ _{0}^{1}n + ____ \rightarrow _{52}^{137}Te + _{42}^{100}Mo + _{0}^{3}n \]

\[ _{12}^{24}Mg^{*} \rightarrow ____ + _{0}^{0}\gamma \]

\[ _{86}^{226}Ra \rightarrow _{26}^{222}Rn + ____ \]

(b) More Practice? CYU Q. 11, 12, 13 p 301 Practice problems p. 317

5. I can explain half-life with reference to rates of radioactive decay

Be able to explain and do calculations involving half-life

(a) Complete the following tables:

<table>
<thead>
<tr>
<th>Half-Life</th>
<th>Percent of parent isotope</th>
<th>Percent of daughter isotope</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Half-Life</th>
<th>Fraction of parent isotope</th>
<th>Fraction of daughter isotope</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) A 24 g sample of a radioactive isotope decayed to 1.5 g in 48 minutes. How much of the original parent isotope remained after 24 minutes?

c. The half-life of a particular radioactive isotope is 6 hours. What percent of the daughter isotope would be present after 1 day?

d. You should also be able to read decay curves. (CYU Q. 9 p. 311)
e. More practice? CYU Q. 6, 7, 9, 12 p. 311
6. I can compare fission and fusion

Compare and contrast fusion and fission
a. Complete the following table

<table>
<thead>
<tr>
<th></th>
<th>Fission</th>
<th>Fusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Does this reaction obey the law of conservation of mass?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Is this reaction used for the production of electrical energy?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) Does this reaction produce radioactive by-products?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d) Does this reaction involve the release of energy?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e) Is this reaction used in nuclear weapons?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Identify the following as fusion or fission

\[ ^2_1 H + ^3_1 H \rightarrow ^4_2 He + ^0_0 n + \text{energy} \]

\[ ^{235}_0 n + ^{92}_{92} U \rightarrow ^{141}_{36} Ba + ^{31}_{56} I + ^0_0 n + \text{energy} \]


Provincial exam practice question: 29 Questions (~35 %, 40 min)

1. Which of the following is an ionic compound?
   A. $\text{H}_2$  B. $\text{NH}_3$  C. $\text{CO}_3^{2-}$  D. $\text{K}_2\text{Cr}_2\text{O}_7$

   Use the following Bohr model diagram to answer the next question.

   ![Bohr model diagram](image)

2. Which of the following is represented by the diagram above?
   A. neon atom  B. carbon ion  C. magnesium ion  D. magnesium atom

   Use the following Bohr model diagram to answer the next question.

   ![Bohr model diagram](image)

3. How many valence electrons are illustrated?
   A. 1  B. 7  C. 16  D. 17
4. How many unpaired electrons are present in a nitrogen atom?

- N

A. 2  B. 3  C. 5  D. 7

Use the following Lewis diagram to answer the next 2 questions.

X:X + :Z:Z:

X and Z represent unknown elements from the periodic table.

5. Which of the following is represented by X : X ?
A. a noble gas  B. an alkali metal  C. a diatomic molecule  D. an alkaline earth metal

6. Which of the following products could be formed from the two molecules represented above?
A. water  B. neon gas  C. carbon dioxide  D. hydrogen fluoride

7. How many lone pairs and bonding pairs of electrons surround the central oxygen atom in a Lewis diagram of water?

H — O:

<table>
<thead>
<tr>
<th></th>
<th>Lone Pairs</th>
<th>Bonding Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

8. Coffee has a pH of 5. Which of the following shows the correct colour of each pH indicator when a small amount of black coffee is tested?

Use the following information to answer the next question.

<table>
<thead>
<tr>
<th>pH Indicator</th>
<th>Test Tube 1</th>
<th>Test Tube 2</th>
<th>Test Tube 3</th>
<th>Test Tube 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>red litmus</td>
<td>no colour change</td>
<td>turns blue</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
<tr>
<td>blue litmus</td>
<td>turns red</td>
<td>no colour change</td>
<td>no colour change</td>
<td>turns red</td>
</tr>
<tr>
<td>phenolphthalein</td>
<td>no colour change</td>
<td>turns pink</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
</tbody>
</table>
9. Which of the following conclusions is supported by the observations?
A. Test Tube 1 is basic 
B. Test Tube 2 is neutral.
C. Test Tube 3 is acidic. 
D. Test Tube 4 is acidic.

10. Which of the following is most likely to cause blue litmus paper to turn red?
A. soap 
B. table salt 
C. lemon juice 
D. oven cleaner 

Use the following information to answer the next question.

Sulphuric Acid Spill Threatens China's 900-Year-Old Grand Canal

Beijing -- Chinese officials attempted to head off an environmental disaster after a ship capsized, dumping 220 tons of sulphuric acid into the country's 900-year-old Grand Canal. Three hundred tons of liquid alkali were poured into the water to neutralize the acid, state media reported. 

Adapted from The Vancouver Sun, Saturday, August 5, 2006, page A18.

11. Which of the following could be the "liquid alkali" that was poured into the Grand Canal?
A. HCl 
B. H₂O 
C. NaCl 
D. NaOH 

12. What is the name of the compound HCN in an aqueous solution?
A. cyanous acid 
B. hydrocyanic acid 
C. hydrogen (I) cyanide 
D. hydrogen carbon nitride 

13. Which of the following is a representation for acetic acid?

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

14. How many atoms of each of the following elements are present in the compound copper (II) phosphate?

<table>
<thead>
<tr>
<th>Element</th>
<th>Copper</th>
<th>Phosphorus</th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. I and II only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. I, III, and IV only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. II, III and IV only</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. What is the name of the compound MnS₂?
   A. manganese sulphide  B. magnesium sulphide  
   C. manganese(II) sulphide  D. manganese(IV) sulphide

16. What is the chemical formula for dinitrogen pentoxide?
   A. NO  B. N₂O₅  C. N₅O₂  D. (N₂O)₅

17. Which of the following is an inorganic compound?
   A. NO₂  B. C₃H₈  C. C₆H₁₂O₆  D. CH₃COOH

18. What is the coefficient needed in front of O₂ in order to balance the following equation?

   ___ NH₄ClO₄ → ___ N₂ + ___ Cl₂ + ___ H₂O + ___ O₂

   A. 1  B. 2  C. 3  D. 4

19. What type of reaction would be expected when sodium phosphate reacts with calcium chloride?
   A. synthesis  B. combustion  C. decomposition  D. double replacement

20. Solid zinc reacts with sulphuric acid to produce hydrogen gas. What is the other product that would result from this reaction?

   ZN + H₂SO₄ → H₂ + ___

   A. O₂  B. H₂S  C. H₂O  D. ZnSO₄

Use the following article to answer question below.

Catalytic Converters

The catalytic converter in a car reduces nitrogen oxide pollution. The converter has a ceramic honeycomb structure plated with platinum and rhodium and is located in the exhaust system close enough to the engine to stay warm. The honeycomb structure provides a large surface area over which the exhaust gases can react. As the gases from the car engine are channeled through the warm honeycomb, the metals remove the oxygen from the nitrogen monoxide (NO) molecules and the oxygen atoms form O₂

2NO → O₂
21. Which of the following are used to speed up this chemical reaction?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>a catalyst</td>
</tr>
<tr>
<td>II</td>
<td>increased temperature</td>
</tr>
<tr>
<td>III</td>
<td>increased surface area</td>
</tr>
</tbody>
</table>

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

Use the following illustration showing the nucleus of an Rb-87 atom to answer the next question.

22. What process is illustrated above?

A. a nuclear reaction producing a beta particle  
B. a nuclear reaction producing an alpha particle  
C. a chemical change producing a hydrogen atom  
D. a nuclear fusion reaction producing two new elements

23. Which of the following is a concern when nuclear energy is used to produce electricity?

A. Nuclear waste material has a very short half-life.  
B. Nuclear energy does not produce a lot of electricity  
C. An accident at a reactor could release a large amount of radioactivity.  
D. Radioactivity emitted during normal operation of a reactor can harm workers or those living nearby.

Use the following cartoon to answer the next question.

At the home for old atoms…

"When I was young I used to feel so alive and dangerous! Would you believe I started life as a uranium-238? Then one day I accidentally emitted an alpha particle. Now look at me -- an old atom of lead-206. It seems that all my life since then has been nothing but decay, decay, decay…"

24. What element was formed during the first decay of uranium-238?

A. lead-206  
B. radium-226  
C. thorium-234  
D. uranium-234
25. Which of the following reactions would produce a proton?

A. \( ^{263}_{106} \text{Sg} \rightarrow ^{259}_{104} \text{Rf} + \) 

B. \( ^{239}_{93} \text{Np} \rightarrow ^{239}_{94} \text{Pu} + \) 

C. \( ^{4}_{2} \text{He} + ^{14}_{7} \text{N} \rightarrow ^{17}_{8} \text{O} + \) 

D. \( ^{1}_{0} \text{n} + ^{235}_{92} \text{U} \rightarrow ^{92}_{36} \text{Kr} + ^{141}_{56} \text{Ba} + \) 

26. Which two of the following atomic models represents elements that can easily combine with each other to form a covalent compound?

A. I and II  
B. I and IV  
C. II and III  
D. III and IV

27. Which of the following Lewis diagrams shows the valence electron arrangement for carbon?

A. 

B. 

C. 

D. 

Use the following Lewis diagrams of four unknown elements to answer the next question.

28. Which element will not combine with oxygen?

A. J  B. K  C. L  D. M
29. Which of the following represents the Lewis diagram of the molecule formed in the reaction shown below?

\[ :\ddot{\text{F}} + :\ddot{\text{F}} \rightarrow ? \]

A. \( \text{F} : \text{F} \)

B. \( \ddot{\text{F}} \cdot \ddot{\text{F}} \)

C. \( \ddot{\text{F}} : \ddot{\text{F}} : \)

D. \( \ddot{\text{F}} \dddot{\text{F}} \cdot \cdot \cdot \dddot{\text{F}} \)
Provincial exam practice question Answers

Unit 2 - Chemistry

1. D  10. C  20. D
8. A  17. A  27. B
19. D  29. C