Science 10
Module 2 Blackline Masters

This blackline master CD is designed to accompany Open School BC's ***Science 10*** course. The CD includes student worksheets and materials for teachers to make their own overhead transparencies or photocopies stored as modifiable Microsoft Word documents. The course and blackline master were developed by BC teachers, instructional designers, graphic artists, and multimedia experts.

Please note that the rights to reproduce materials from the *Science 10 Blackline Master* is restricted to the individual purchaser. Teachers may reproduce solely for use within their own classes.

The ***Science 10*** course consists of five modules, *Science 10 SOS Package*, *Science 10 Kit*, *Blackline Master CD* and the *Science 10 Media CD*. Science 10 is available in both print and online formats. Science 10 can be purchased as individual components or as a complete resource, *Science 10 Resource Package*. There are no additional resources required for this course.

To order, contact:

Open School BC Customer Service team
Phone: 250-356-2820 (Victoria)
1-888-883-4766 (Toll-free)
info@openschool.bc.ca

OR

Visit our website at
www.pss.gov.bc.ca/osbc/

Blackline Masters List of Contents

Mod 1

GP 1.1A 1: Evidence for the Continental Drift Theory
GP 1.1B 2: Seafloor Spreading
Try It Out! (Density Layers) and GP 1.1D 1: Try It Out! Results
GP 1.1D 3: Name That Layer!
SA 1.1

GP 1.2B 1: Oceanic-Continental Plate Boundaries
GP 1.2B 2: Oceanic-Oceanic Plate Boundaries
SA 1.2

Mod 2

GP 2.1A 2: The Number of Subatomic Particles
GP 2.1A 5: Bohr Modeler Ions
GP 2.1A 6: Isotope Practice Activities
GP 2.1B 1: Ionic or Covalent?
GP2.1B 2: Covalent Combining Capacities
SA 2.1

GP 2.2A 1: Comparing Acids, Bases and Salts
pH Scale (graphic in Lesson 2.2B)
GP 2.2C 1: Simple Ionic Compounds
GP 2.2C 2: Ionic Compounds with Multivalent Metals
GP 2.2C 3: Using Polyatomic Ions
GP 2.2D 1: Naming Covalent Compounds
GP 2.2D 2: Formula Writing for Covalent Compounds
GP 2.2D 3: Names and Formulae of Acids
SA 2.2

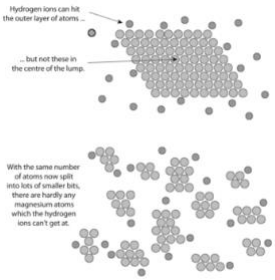
In one document (called "Naming Organic Compounds"), combine the following items from Lesson 2.3B:

- Graphic: Ethane, Ethene, Ethyne
- Graphic: Number Prefixes Used in Organic Compounds
- Table with "number of carbons" and "prefix"

SA 2.3

Symbols Used in Chemical Equations (table from Lesson 2.4A)
GP 2.4A 1: Balancing Equations
GP 2.4B 2: Classifying Reactions
Summary of Reaction Types (table from Lesson 2.4B Summary)

Surface Area and Reaction Rate (from Lesson 2.4D include the following text and the graphic (shown in the screen shot below)
"To illustrate the effect of surface area on reaction rate, let's look at the reaction between magnesium metal and dilute hydrochloric acid). The reaction involves collisions between hydrogen ions (found in the dilute acid solution) and the magnesium metal.
$Mg_{(s)} + 2H^{+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + H_{2(g)}$ "



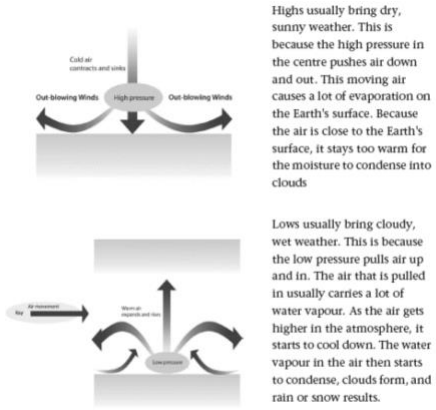
SA 2.4

GP 2.5A 2: Vocabulary Matching Quiz
SA 2.5

Mod 3

Table: States of Matter (from lesson 3.1A)
Try It Out! Heat Transfer (from Lesson 3.1B)
Summary of Heat Transfer (table from Lesson 3.1B summary)
Graphic: Energy From the Sun (from lesson 3.1D)
SA 3.1

High and Low Pressure Systems (as shown in screen capture below)

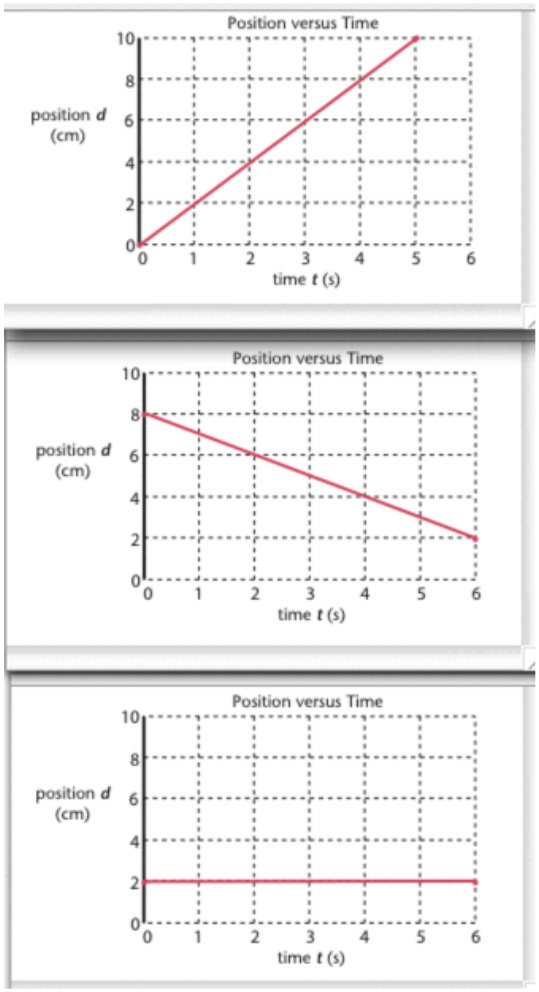


GP 3.2B 1: Weather and Pressure
SA 3.2

SA 3.3

Mod 4

Slope of "Position vs. Time" Graphs (graphics and content from Lesson 4.1D. I set it up below with screen shots to show how I'd like it set up. I only used a table to make it easier for myself – you don't need to use a table.)

Slope of "Position vs. Time" Graphs	
Positive Slope A positive slope means a positive constant velocity. The object could be moving • forward • to the right • north • east **Negative Slope** A negative slope means a negative constant velocity. The object could be moving • backward • to the left • south • west **Zero Slope** A horizontal line (zero slope) means that vav = 0. This means that the object is not moving at all	

GP 4.1D 3: Slope and Velocity
SA 4.1

GP 4.2A 2: Acceleration
GP 4.2B 2: Positive Acceleration and Velocity-Time Graphs
GP 4.2C 2: Graphing Negative Acceleration
GP 4.2C 3: Velocity versus Time Graphs
Acceleration Due to Gravity (from Lesson 4.2D. Please include the graphics and text on pg 91-92 describing motion of a ball. If possible, arrange so it fits on one page. Would be nice to have graphic on the left, text on the right. You can shrink the graphics a bit if needed)

SA 4.2

Mod 5

Energy Flow Through an Ecosystem (graphic from lesson 5.1C with sun, producer consumer, decomposer – on pg. 22)
Food Web (graphic from Lesson 5.1C - pg 27)
Food Pyramid (graphic from Lesson 5.1C - pg 30)
GP 5.1D 1: Symbiotic Relationships Chart
SA5.1

GP 5.2B 1: The Nitrogen Cycle
GP 5.2C1: The Phosphorus Cycle
SA 5.2

SA 5.3

SA 5.4

GP 5.5A 1: Looking for the Best "Fit"
Predator-Prey Cycle (graphic from lesson 5.5B showing population cycle of lynx and hare on pg 173)
GP 5.5C 1: Changing Communities
GP 5.5D 1: The Burning Question
SA 5.5

Module 5 Assignment

Guided Practice 2.1A 2
The Number of Subatomic Particles

For the following exercises, you may use the *Alphabetical List of the Elements* to help you find the symbols.

Go to:

Science 10 Media CD > Science 10 Data Booklet > **Alphabetical List of the Elements**

Step A:

Fill in the blank spaces in the tables.

Table 1

Element	Symbol	Atomic Number	Number of Protons
Hydrogen		1	
Carbon		6	
Fluorine			9
Sodium			11
Phosphorus			15

Table 2

Element	Symbol	Mass Number	Number of Protons	Number of Neutrons
Hydrogen		1	1	
Beryllium		9	4	
Nitrogen		14	7	
Carbon			6	6
Oxygen			8	8

Table 3

Element	Symbol	Mass Number	Atomic Number	Number of Protons	Number of Electrons	Number of Neutrons
Hellium		4		2		2
Lithium		7		3		4
Boron		11		5		6
Carbon				6		6
Fluorine				9		10

Step B:

Answer the following questions in your Science Notebook.

1. In Table 1, how did you find the number of protons?

2. A. In Table 2, how did you find the number of neutrons?

   B. In Table 2, how did you find the mass numbers?

   C. How did you find the number of protons?

3. In Table 3, how did you find the number of electrons?

4. A. Make an expression that shows the relationship between mass number, the number of protons, and the number of neutrons.

   B. Make an expression that shows the relationship between atomic number, number of protons, and number of electrons in a neutral atom.

Guided Practice 2.1A 5
Bohr Modeler Ions

1. Construct Bohr models of the ions of each of the first twenty elements of the periodic table using the following interactive activity.

   Go to:

   Science 10 Media CD > Module 2 > **Bohr Modeler Ion and Isotope Version**

2. Complete the table below based on what you have learned from the modeler.

Chemical Family	**Name**	**Ion Charge (if any)**	**Number of Electrons Gained or Lost**	**Ion Symbol**
Alkali Metals	Lithium			
Alkaline Earth Metals	Magnesium			
Halogens	Fluorine			
Noble Gases	Argon			

Guided Practice 2.1A 6
Isotope Practice Activities

Complete both tables below using the following interactive activity (Table 1) and the *Periodic Table of Elements* (Table 2).

Go to:

Science 10 Media CD > Module 2 > **Bohr Modeler Ion and Isotope Version**

Step 1: Bohr Modeler Isotopes

Isotope	Number of Protons	Number of Neutrons	Mass Number	Symbol
Tritium (Hydrogen 3)				
Beryllium 7				
Carbon 13				
Carbon 14				
Oxygen 18				
Phosphorus 32				
Sulphur 35				
Calcium 41				

Step 2: Symbols of Isotopes

Isotope	Symbol (include superscript and subscript)	Number of Protons	Number of Neutrons
Hydrogen 3			
Copper 65			
Sulphur 32			
Uranium 235			
Uranium 238			

Guided Practice 2.1B 1
Ionic or Covalent?

So far in this lesson you have learned that ionic bonds between positive and negative ions form ionic compounds. When non-metal atoms share electrons, covalent bonds form.

Identify the following compounds as either ionic or covalent.

1. $CaCl_2$ _____

2. O_2 _____

3. CO_2 _____

4. $AlCl_3$ _____

5. LiBr _____

6. H_2O_2 _____

Guided Practice 2.1B 2
Covalent Combining Capacities

Complete the following table. You may use your *Periodic Table of Elements*. The first one is done for you.

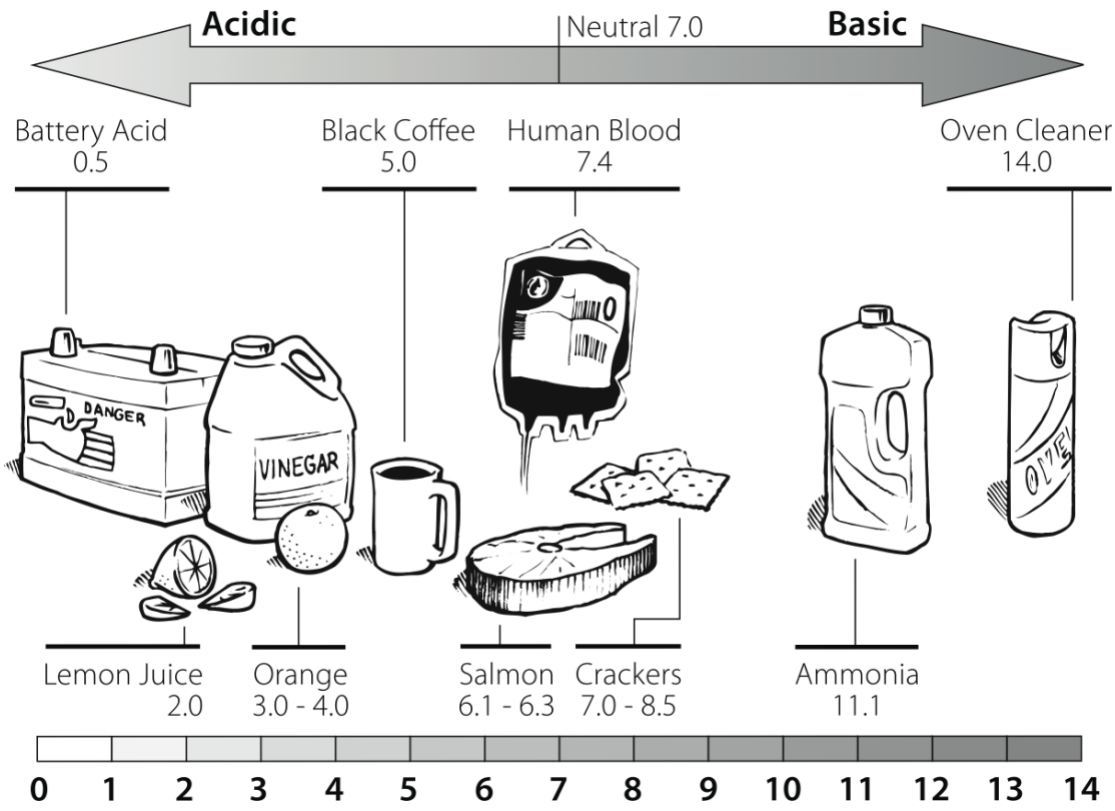
Symbol	Name	Combining Capacity	Number of Electrons Shared
B	boron	+3	3
C			
N			
O			
F			
Si			
P			
S			
Cl			

Guided Practice 2.2A 1
Comparing Acids, Bases, and Salts

As you go through this lesson, use one of the following documents to organize your notes. Complete the table showing differences among acids, bases, and salts.

	Acids	**Bases**	**Salts**
Colour of Litmus Paper			
Taste			No Answer Required
Reaction with Metals			No Answer Required
Feel	No Answer Required		No Answer Required
Does It Conduct Electricity?			
Common Examples (give 2)			

pH scale


Acidic
Neutral 7.0
Basic
Battery Acid
0.5
Black Coffee
5.0
Human Blood
7.4
Oven Cleaner
14.0
DANGER
VINEGAR
Lemon Juice
2.0
Orange
3.0 - 4.0
Salmon
6.1 - 6.3
Crackers
7.0 - 8.5
Ammonia
11.1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Guided Practice 2.2C 1
Simple Ionic Compounds

Using what you know about naming and formula writing, please complete the following table.

Name	Formula
	Li_2O
	KI
	ZnF_2
	LiBr
beryllium oxide	
magnesium sulphide	
calcium chloride	
hydrogen phosphide	

Guided Practice 2.2C 2
Ionic Compounds with Multivalent Metals

Complete the following table.

Name	Formula
cobalt(III) chloride	
tin(IV) bromide	
mercury(II) oxide	
	$PbCl_4$
	MnO_2
	MnI_2

Guided Practice 2.2C 3
Using Polyatomic Ions

1. Write the formulae for the following compounds.

Name	Formula
sodium carbonate	
calcium sulphate	
sodium nitrite	
magnesium chlorate	
copper(II) hydroxide	
potassium sulphite	

2. Name these compounds:

Name	Formula
	KOH
	$CuSO_4$
	NH_4OH
	$NaNO_3$
	Fe(OH)2

Guided Practice 2.2D 1
Naming Covalent Compounds

We stated earlier that we use the prefix naming system because some non-metal combinations are capable of forming more than one compound. Completing the following activity will help you to see the importance of using those prefixes correctly.

Complete the following table using the rules you've learned for naming covalent compounds.

Formula	Name
NO	
N_2O	
NO_2	
N_2O_4	
N_2O_5	
SI_6	
CO	
CO_2	
SO_2	
SO_3	

Guided Practice 2.2D 2
Formula Writing for Covalent Compounds

Now you can try naming and formula writing of covalent compounds!

1. Write the formulas for the following covalent compounds:

Elements or Names	Formula
Boron trichloride	
Boron and bromine	
Boron and fluorine	
Diboron trisulfide	
Boron and phosphorus	
Silicon dioxide	
Selenium hexafluoride	
Tellurium tetrabromide	
Carbon monoxide	
Sulphur trioxide	

2. Use the prefix system to name the following covalent compounds:

Formula	Name
B_2O_3	
BCl_3	
BN	
B_2Te_3	
BI_3	
CO_2	
SiO	
$SeBr_4$	
SI_6	
C_3N_4	

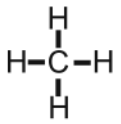
Guided Practice 2.2D 3
Names and Formulae of Acids

Complete the following table.

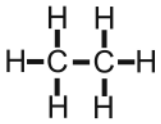
Formula	Name
H_2SO_4	
H_2SO_3	
	hydrofluoric acid
	carbonic acid
$HCL_{(aq)}$	
	hydrobromic acid
H_3PO_4	
	nitric acid
HNO_2	

Naming Organic Compounds

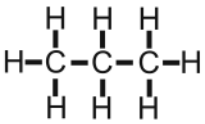
Number of Carbons	Prefix
1	meth-
2	eth-
3	prop-
4	but-
5	pent-
6	hex-
7	hept-
8	oct-
9	non-
10	dec-



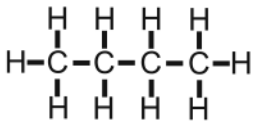
methane



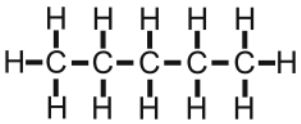
ethane



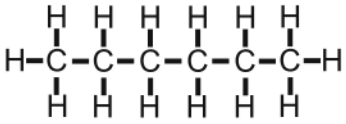
propane



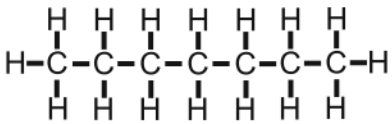
butane



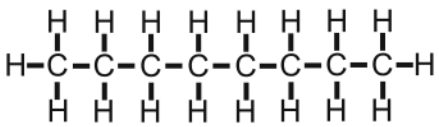
pentane



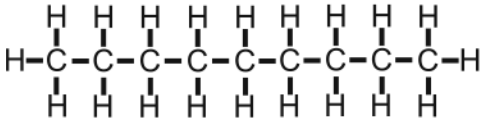
hexane



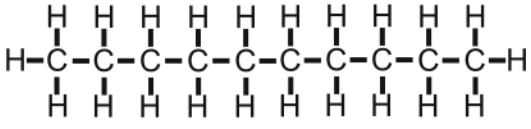
heptane



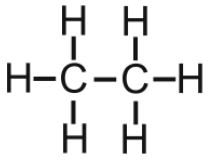
octane



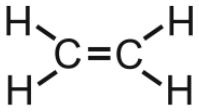
nonane



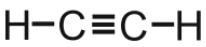
decane



ethane



ethene



ethyne

Guided Practice 2.4A 1
Balancing Equations

1. State the Law of Conservation of Mass.

   _____

   _____

2. In a chemical equation, the arrow:
   A. is not necessary.
   B. should be replaced by an equal sign.
   C. points to the reactants.
   D. points to the products.

3. Which of the following is the correct balanced equation for the reaction of hydrogen and oxygen to form water?
   A. $H_2O + O \rightarrow H_2O$
   B. $2H_2 + O_2 \rightarrow 2H_2O$
   C. $H + O_2 \rightarrow HO_2$
   D. $H_2 + O \rightarrow H_2O$

4. Which of these is a balanced equation?
   A. $K_2S + H_2SO_4 \rightarrow 2K_2SO_4 + H_2S$
   B. $2K_2S + H_2SO_4 \rightarrow 2K_2SO_4 + H_2S$
   C. $K_2S + H_2SO_4 \rightarrow K_2SO_4 + H_2S_2$
   D. $2K_2S + H_2SO_4 \rightarrow 2K_2SO_4 + H_2S$
   E. $K_2S + H_2SO_4 \rightarrow K_2SO_4 + H_2S$

5. Write in the appropriate coefficients to make the number of atoms on the left side equal the number of atoms on the right side.
   A. _____Mg + _____$HCl \rightarrow$ _____$MgCl_2$ + _____H_2
   B. _____Mg + _____$N_2 \rightarrow$ _____Mg_3N_2
   C. _____Ba + _____$HBr \rightarrow$ _____$BaBr_2$ + _____H_2
   D. _____Br_2 + _____$KI \rightarrow$ _____I_2 + _____KBr
   E. _____H_2SO_4 + _____$Ba(OH)_2 \rightarrow$ _____$BaSO_4$ + _____H_2O

F. _____$AgNO_3$ + _____Na_2S → _____Ag_2S + _____$NaNO_3$

G. _____NH_4NO_3 → _____N_2O + _____H_2O

H. _____$BaCl_2$ + _____$MgSO_4$ → _____$BaSO_4$ + _____$MgCl_2$

I. _____Ag_2SO_4 + _____$AlCl_3$ → _____$AgCl$ + _____$Al_2(SO_4)_3$

J. _____CaO + _____MnI_4 → _____MnO_2 + _____CaI_2

6. Change each of the following word equations into a chemical equation, then balance it:

   A. Hydrogen fluoride + aluminum hydroxide → aluminum fluoride + water

   B. Potassium + calcium chloride → potassium chloride + calcium

   C. Copper(I) nitrate + zinc iodide → zinc nitrate + copper(I) iodide

   D. Sodium hydroxide + barium sulphide → sodium sulphide + barium hydroxide

   E. Gold(III) chloride + copper → copper(II) chloride + gold

   F. Sodium hydroxide produces sodium oxide and water.

G. Iron plus oxygen produces iron(III) oxide.

H. Dichloride plus sodium iodide yields sodium chloride and diiodide.

I. Iron(II) sulfide plus hydrogen chloride (hydrochloric acid) yields iron(II) chloride and hydrogen sulfide.

J. Oxygen plus hydrogen yields water.

7. Balance the following equations. Don't forget to reduce to simplest form:

A. _____C_2H_6 + _____O_2 → _____CO_2 + _____H_2O

B. _____S + _____O_2 → _____SO_3

C. _____$KClO_3$ → _____KCl + _____O_2

D. _____N_2 + _____H_2 → _____NH_3

E. _____CH_4 + _____O_2 → _____CO_2 + _____H_2O

F. _____$CaSO_4$ + _____$AlBr_3$ → _____$CaBr_2$ + _____$Al_2(SO_4)_3$

Symbols Used in Chemical Equations

Symbol	Meaning
(s)	Solid. The substance is in a solid state.
(l)	Liquid. The substance is in a liquid state.
(g)	Gas. The substance is in a gaseous state.
(aq)	Aqueous. The substance is dissolved in water.
6 H_2O	The coefficient. This is the large number in front of the formula. It shows the number of entire molecules of that substance.
O_2	The subscript. This is the small number after a symbol. It tells us the number of atoms in the element or unit to its left.
+	"Plus" or "and." This is placed between reactants to show they are being combined. It is also placed between products that are formed.
→	"Yields" or "produces." This separates the reactants from the products and shows the direction of the chemical reaction.

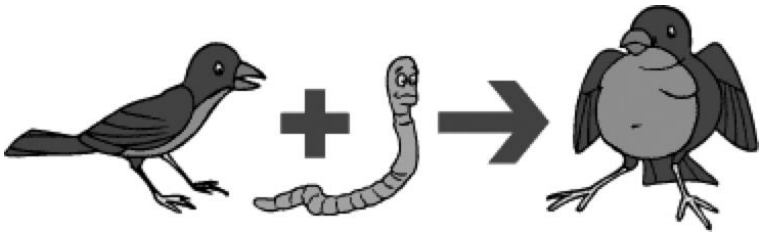
Guided Practice 2.4B 2
Classifying Reactions

1. A single replacement reaction is when:
   A. two reactants joint to form a compound.
   B. two new compounds are formed from one reacting compound.
   C. elements in two compounds exchange places.
   D. one element replaces another element in a compound.

2. A double replacement reaction is when:
   A. two reactants joint to form a compound.
   B. two new compounds are formed from one reacting compound.
   C. elements in two compounds exchange places.
   D. one element replaces another element in a compound.

3. A neutralization reaction is when:
   A. a compound combines with water to form an acid.
   B. an acid and a base combine to produce salt and water.
   C. one element replaces another element in a compound.
   D. both b and c.

4. Describe the following cartoons in the terms of a chemical reaction:
   A.



   Description: _____

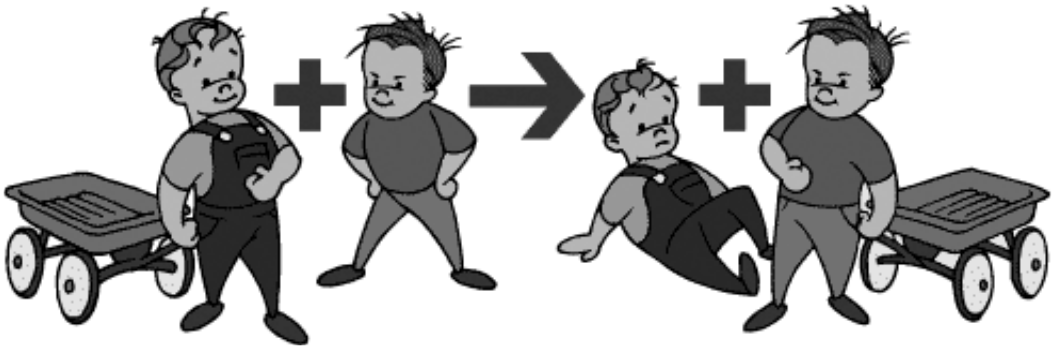
   Type of reaction: _____

B.

Description: _____

Type of reaction: _____

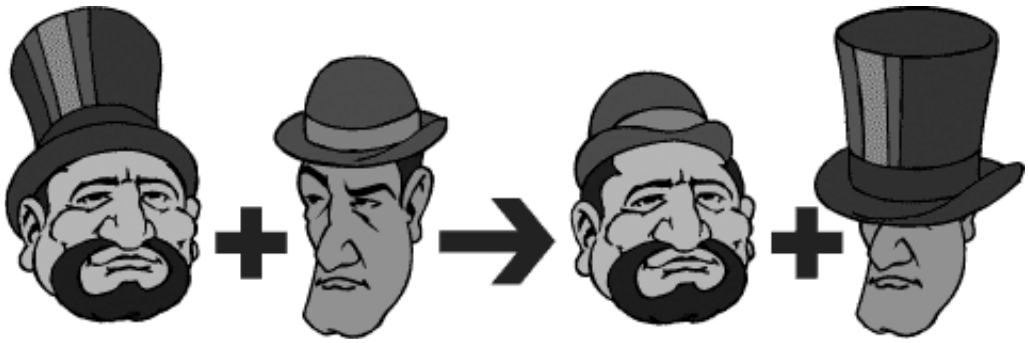
C.



Description: _____

Type of reaction: _____

D.



Description: _____

Type of reaction: _____

5. Change the following word equations into chemical equations and balance. Name the type of reaction. (Don't forget that hydrogen and oxygen on their own exist as diatomic molecules.)

   A. Sodium hydroxide produces sodium oxide and water.

      _____

      Type of reaction: _____

   B. Iron plus oxygen produces iron(III) oxide.

      _____

      Type of reaction: _____

   C. Dichloride plus sodium iodide yields sodium chloride and diiodide.

      _____

      Type of reaction: _____

   D. Iron(II) sulfide plus hydrogen chloride (hydrochloric acid) yields iron(II) chloride and hydrogen sulfide.

      _____

      Type of reaction: _____

   E. Oxygen plus hydrogen yields water.

      _____

      Type of reaction: _____

   F. Hydrogen nitrate (nitric acid) plus calcium hydroxide produces calcium nitrate and water.

      _____

      Type of reaction: _____

   G. Methane (carbon tetrahydride) plus oxygen produces carbon dioxide and water and heat energy.

      _____

      Type of reaction: _____

6. Determine the reaction type for each of the following equations.

A. $Ca(OH)_2 + H_3PO_4 \rightarrow Ca_3(PO_4)_2 + H_2O$ _____

B. $2Na + 2H_2O \rightarrow 2NaOH + H_2$ _____

C. $HCl + FeS \rightarrow FeCl_2 + H_2S$ _____

D. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ _____

E. $Fe_2O_3 + 3C \rightarrow 3CO + 2Fe$ _____

F. $HCl + NaOH \rightarrow H_2O + NaCl$ _____

G. $C_{10}H_{16} + 8Cl_2 \rightarrow 10C + 16HCl$ _____

H. $AgNO_3 + Cu \rightarrow CuNO_3 + Ag$ _____

I. $FeCl_2 + K_2S \rightarrow FeS + 2KCl$ _____

J. $Pb(NO_3)_2 + K_2CrO_4 \rightarrow PbCrO_4 + 2KNO_3$ _____

K. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ + heat energy _____

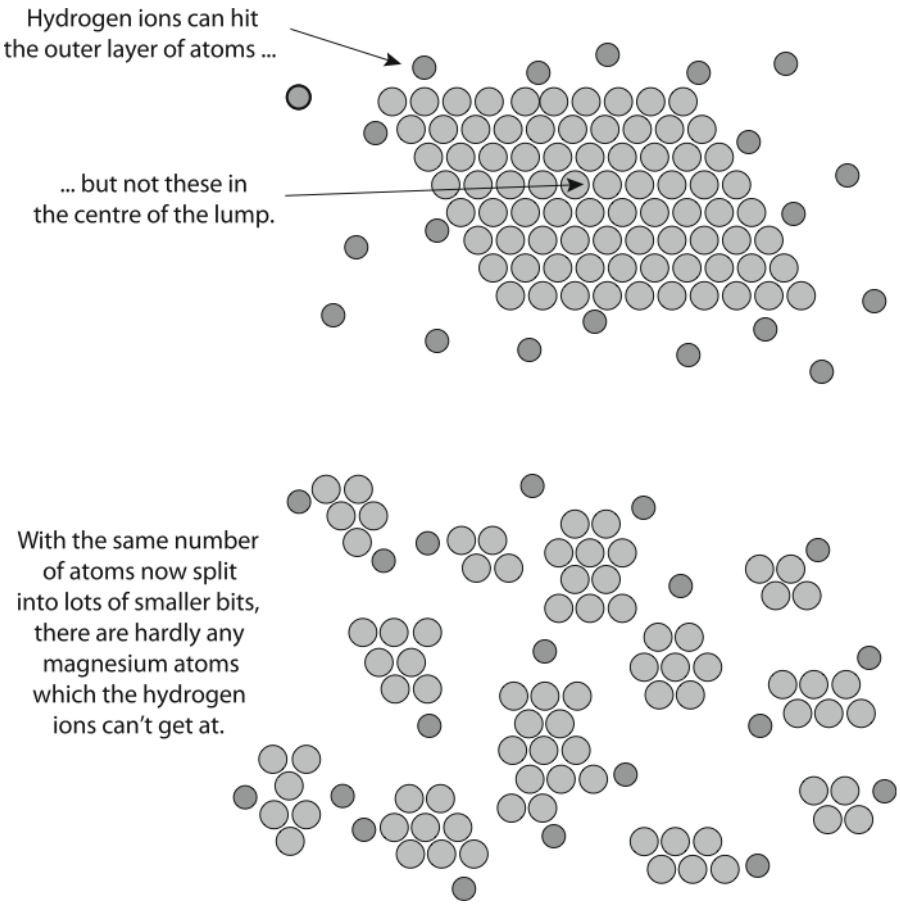
Summary of Reaction Types

Reaction Type	Description
synthesis	two different atoms combine to produce one compound
decomposition	one molecule breaks apart to produce two or more new atoms or molecules
single replacement	one element in a compound is replaced by another element
double replacement	two reactants exchange ions or break bonds and form different compounds
neutralization	a double replacement reaction of acid and base (alkali) to form salt and water
combustion	a reaction with oxygen to produce oxides and heat

Surface Area and Reaction Rate

To illustrate the effect of surface area on reaction rate, let's look at the reaction between magnesium metal and dilute hydrochloric acid. The reaction involves collisions between hydrogen ions (found in the dilute acid solution) and the magnesium metal.

$$Mg_{(s)} + 2H^{+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + H_{2(g)}$$



Guided Practice 2.5A 2
Vocabulary Matching Quiz

Please match the correct definition to each term in the following quiz.

1. isotope _____
2. radiation _____
3. alpha radiation _____
4. beta radiation _____
5. gamma radiation _____

a. a high-speed electron

b. atoms of an element that have the same number of protons, but a different number of neutrons

c. emission from unstable atoms during radioactive decay

d. high energy waves with no mass and no charge

e. particles that consist of two protons and two neutrons

Section Assignment 2.1
Atomic Theory and Bonding

1. A. Write a Bohr diagram and a Lewis diagram for each of the following elements: (3 marks)

   1. lithium

   2. carbon

   3. fluorine

   B. Compare and contrast the characteristics of the Bohr diagrams and the Lewis diagrams. You might want to use a Venn diagram to organize the information. (6 marks)

   For more information on Venn diagrams go to:

   Science 10 Media CD > SOS package > **Toolbox #6**

2. Carbon has three kinds of isotopes: carbon-12, carbon-13, and carbon-14. Carbon-12 is the most common and stable isotope. Carbon-13 is also stable, but rare (about 1% of carbon). Carbon-14 is radioactive and is used for carbon dating (which you will explore further in Section 5).

   Please write the nuclear notation **and** calculate the number of neutrons for carbon-12, carbon-13, and carbon-14. (3 marks)

3. Complete the table. Identify each as an ionic or covalent compound. (22 marks)

Molecular Formulae	Names	Covalent/Ionic
NaCl		
O_2		
	sodium sulfide	
	calcium chloride	
H_2O		
HBr		
	barium chloride	
CaO		
	nitrogen monoxide	
	boron fluoride	
SO_2		

4. Briefly describe the characteristics of covalent bonds and ionic bonds. (4 marks)

5. Describe where you can find metals and non-metals in the periodic table of the elements. (2 marks)

6. Write the nuclear notation for fluorine and list the numbers of protons, electrons, and neutrons of a fluorine atom. (2 marks)

7. Put the following sets of elements in order from least reactive to most reactive. (4 marks)

   A. Li, Rb, K

   B. B, F, O

   C. selenium, oxygen, sulphur

   D. aluminum, sodium, magnesium

Marks
46

Section Assignment 2.2 Part A
Lab Activity: Acid and Base Tests

Note:

Once you have completed this activity, you will need to complete a formal lab report and submit it to your teacher. See the *SOS package Lab Report Directions* for the required format.

Go to:

Science 10 Media CD > SOS package > **Tool #3 Lab Report Directions**

Purpose:

- To observe the behaviours of acids and bases.
- To classify a series of unknown solutions as either acids or bases.

Hypothesis:

Record the hypothesis in your Science Notebook until you are ready to complete the report. (2 marks)

Materials:

Parts A and B

From the *Science 10 Lab Kit*:

- phenolphthalein solution
- bromthymol blue solution
- safety goggles
- six medicine droppers
- red litmus paper
- blue litmus paper

Supplied by you:

- apron
- six test tubes, water glasses, mugs, or jars (referred to as *glass containers* in the activity)
- plastic wrap

Part A supplied by you:

- white vinegar (acid solution)
- Windex® or very dilute bleach (base solution)

Part B supplied by you:

- clear plastic
- six prepared unknown solutions, labelled A to F

  Unknown solutions may include the following:

  - club soda
  - aspirin
  - baking soda
  - very dilute Saniflush®
  - lemon
  - Tums®
  - limewater
- list of prepared solutions recorded separately and matched to each label, to check results
- two copies of Table 2

Preparation:

Have a friend or family member prepare one of the six solutions in each glass container, and label them from A to F. He or she should record the names of the solutions in a separate list so you can check your results afterwards.

Ensure that each glass container has enough of each unknown solution for a medicine dropper to retrieve liquid. Place a clean medicine dropper in each glass container.

Procedure:

Part A: Vinegar and Windex® (or Bleach)

1. Record Table 1 in your Science Notebook.

2. Put on your apron and safety goggles.

3. Add three to four drops of phenolphthalein indicator in a glass container. Then add a drop of white vinegar. In Table 1, record what you observe.

4. Add three to four drops of bromthymol blue indicator in a glass container. Then add a drop of white vinegar. In Table 1, record what you observe.

5. Put a piece of red litmus paper in a glass container. Then add a drop of white vinegar. In Table 1, record what you observe.

6. Put a piece of blue litmus paper in a glass container. Then add a drop of white vinegar. In Table 1, record what you observe.

7. Repeat steps three through six using Windex® or very dilute bleach instead of white vinegar.

Table 1: Vinegar and Windex® (or Bleach) (2 marks)

Indicators	Colour in Acid	Colour in Base
Phenolphthalein		
Bromthymol blue		
Red litmus		
Blue litmus		

Questions:

1. What happens when you add acid to phenolphthalein, bromthymol blue, blue litmus, and red litmus? (2 marks)

2. What happens when you add a base to phenolphthalein, bromthymol blue, blue litmus, and red litmus? (2 marks)

3. What explanation can be provided for any indicator that shows no change? (1 mark)

Part B: Unknown Solutions

1. Include a copy of Table 2 in your Science Notebook, and have another copy on hand.

2. Put on your apron and safety goggles.

3. Place a sheet of clear plastic over top of the copy of Table 2 on hand. On the plastic, place one or two drops of phenolphthalein and bromthymol blue indicator according to the labels in the table.

   Now take small pieces of red and blue litmus paper and place them on the plastic according to the labels in the table.

4. With the medicine dropper, place one or two drops of unknown solution A in the square with the phenolphthalein. Write what you observe in the copy of the table in your Science Notebook.

5. Place one or two drops of unknown solution A to the bromthymol blue, blue litmus, and red litmus squares. Write what you observe in the copy of the table in your Science Notebook.

6. Repeat steps 4 and 5 using unknown solutions B, C, D, E, and F.

Table 2: Unknown Solutions (4 marks)

Unknown Solution	Phenolphthalein	Bromthymol Blue	Blue Litmus	Red Litmus
A				
B				
C				
D				
E				
F				

Questions:

1. Can you identify which solutions are acids and which are bases? (1 mark)

2. Explain the reasoning for your answer to the first question. (1 mark)

3. Define “acid” and “base,” using evidence from your tests as part of the basis for your definitions. (2 marks)

4. Explain how you would conduct a test to determine whether an unknown solution is an acid or a base. (1 mark)

5. If no colour change occurs when you conduct a test, what can you conclude? (1 mark)

6. What is present in a solution if red litmus remains red and blue litmus remains blue when placed in the solution? (1 mark)

Observations:

Fill in your observations in the copy of Table 2 in your Science Notebook.

Conclusion:

On the basis of your observations and your answers to the questions for Parts A and B, summarize the conclusions that you can make about acids and bases. Be sure to relate your findings back to your hypothesis for the lab activity. (5 marks)

Marks
25

Section Assignment 2.2 Part B
Chemical Formulas Multiple Choice Quiz

Choose the best answer for each statement or question.

1. Atoms tend not to be very reactive if they:
   A. have more than two shells
   B. have complete outer shells
   C. have a combining capacity of 2+
   D. have incomplete outer shells

2. An example of a covalent compound is:
   A. NaCl
   B. Fe_2O_3
   C. SO_3
   D. HNO_3

3. The correct formula for iron (III) oxide is:
   A. Fe_2O_3
   B. Fe_3O
   C. $2FeO_3$
   D. Fe_3O_2

4. The number of oxygen atoms in $6CH_3COOH$ is:
   A. 2
   B. 6
   C. 12
   D. 4

5. Which of the following is a polyatomic ion with a combining capacity of +1?
   A. $(SO_4)^{2-}$
   B. Na^+
   C. $(NO_3)^-$
   D. $(NH_4)^+$

6. An ionic bond would be found in which of the following?
   A. water
   B. sodium chloride
   C. carbon dioxide
   D. chlorine gas

7. Which of the following is the formula for the covalent compound dinitrogen tetroxide?
   A. N_2O_4
   B. NO_2
   C. $2N_4O$
   D. N_4O_2

8. The correct formula for aluminum sulphate is:
   A. Al_2SO_4
   B. $Al(SO_4)_3$
   C. $Al_3(SO_4)_2$
   D. $Al_2(SO_4)_3$

9. How many atoms are contained in one molecule of H_2SO_3?
   A. 3
   B. 4
   C. 5
   D. 6

10. The name given to an arrangement of symbols which represent one molecule of a compound is called a(n):
    A. formula
    B. equation
    C. symbol
    D. subscript

Marks
10

Section Assignment 2.2 Part C
Names, Formulas, and Bond Types

Complete the following table. The first line is done for you.

Formula	Name	Ionic or Covalent Compound?
NaCl	sodium chloride	Ionic
	potassium oxide	
Fe_2O_3		
NO		
	sodium bromide	
SiO_2		
	dinitrogen pentoxide	
	iron(III) nitrate	
	silver sulphate	
F_2		
	sulphuric acid	
H_2SO_3		
O_2		
	sodium carbonate	
	carbon tetrachloride	
$AlPO_4$		
	magnesium chloride	
	hydrogen molecule	
H_2CO_3		
CH_3COOH		
SF_6		

Marks
20

Section Assignment 2.3 Part A
Oil and the Environment

We use many products produced from oil that help us in a variety of ways. We use them to run our cars, airplanes, boats, heat our homes, and produce electricity. We use them for producing medicine, fabric, lubricants, plastic, and construction materials. If you look around, you will be surprised by how much our lives depend on them. In fact, an industrialized society cannot exist without the use of oil. Unfortunately, it takes millions of years to produce crude oil. This resource that we rely so heavily on is not renewable in a practical sense.

You can see that we receive many benefits from petroleum technology. At the same time, you may be aware of the problems this technology has created.

Global warming due to the greenhouse effect is currently a great concern. Global warming is influenced by carbon dioxide, which is given off when we burn petroleum products. Beyond climate concerns, the use of petroleum products also causes pollution in the form of carbon monoxide, nitrogen oxides, unburned hydrocarbons, and other solid pollutants. Landfills are full of plastic wastes which are not biodegradable (they can never be decomposed).

Environmental scientists use chemistry in an attempt to reduce pollution and to find solutions to existing environmental problems.

Petroleum Report

Either write a short report or create a poster, pamphlet, Powerpoint presentation or participate in a discussion on one or more of the following topics. Please make sure that you check with your teacher about appropriate assignment formats **before** you complete your assignment.

- Discuss what kinds of compounds are found in crude oil.
- List what kinds of products are produced from petrol.
- Discuss the importance of petroleum products in our lives.
- Discuss the impacts of using crude oil as an energy source.
- Discuss how we should use fossil fuels in a sustainable way.

For the discussion, make a short title for your post. Write your opinions in a clear and logical order. Read other people's posts and post at least five responses.

To begin your research on petroleum, check out the *Science 10 Web Site* under *Lesson 2.3A: Organic and Inorganic Compounds*.

You may continue your research on the Internet or at the library if you require additional information.

Please use language that is appropriate for schoolwork.

ASSESSMENT GUIDELINES

Marking for the short report, poster, pamphlet, and presentation will be based on the following points.

- The report was of appropriate content with an appropriate title. (2 points)
- The argument was clear, logical, and concise. (3 points)
- Good factual information was provided. (3 points)
- Both a good style of writing and correct spelling were used. (2 points)

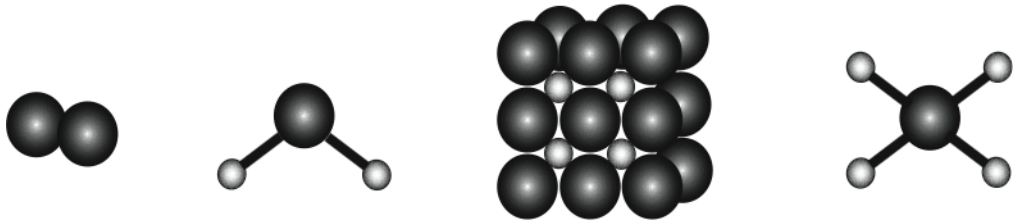
Marking for the discussion will be based on the following points.

- The post was of appropriate content with an appropriate title. (2 points)
- The argument was clear, logical, and concise. (3 points)
- Good factual information was provided. (3 points)
- Effort was made to participate in discussion. At least 5 responses were posted. (1 point)
- Polite and considerate manners were used. (1 point)

Marks
10

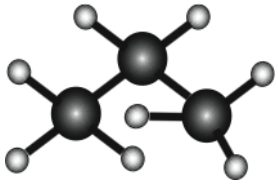
Section Assignment 2.3 Part B
Inorganic or Organic?

1. Using the diagrams, fill in the following table. (6 marks)



Names	Enter A, B, C, or D (1 mark each)	Inorganic or Organic? (0.5 marks each)
oxygen		
sodium chloride		
methane		
water		

2. Look at the following structure.



The large spheres represent carbon. The small spheres represent hydrogen.

A. Name the compound. (1 mark)

_____

B. Write the formula for the compound. (1 mark)

_____

C. State whether the compound is organic or inorganic. (1 mark)

_____

3. Label each of the following as either inorganic or organic. (5 marks)

A. C_3H_8 _____

B. C_2H_6O _____

C. $CuCl_2$ _____

D. hexane _____

E. CO_2 _____

F. calcium hydroxide _____

G. C_6H_{12} _____

H. H_2CO_3 _____

I. NO_2 _____

J. methane _____

Marks
14

Section Assignment 2.4 Part A
Balancing and Classifying Chemical Equations

Balance the following equations then classify the type of reaction.

1. _____NH_3 → _____H_2 + _____N_2

   Type of reaction: _____

2. _____H_3PO_4 + _____NaOH → _____Na_3PO_4 + _____H_2O

   Type of reaction: _____

3. _____$AlBr_3$ + _____K_2SO_4 → _____KBr + _____$Al_2(SO_4)_3$

   Type of reaction: _____

4. _____NH_3 + _____H_2SO_4 → _____$(NH_4)_2SO_4$

   Type of reaction: _____

5. _____Li_3N + _____NH_4NO_3 → _____$LiNO_3$ + _____$(NH_4)_3N$

   Type of reaction: _____

6. _____N_2 + _____H_2 → _____NH_3

   Type of reaction: _____

7. _____HBr + _____$Al(OH)_3$ → _____H_2O + _____$AlBr_3$

   Type of reaction: _____

8. _____F_2 + _____NaCl → _____NaF + _____Cl_2

   Type of reaction: _____

9. _____$KClO_3$ → _____KCl + _____O_2

   Type of reaction: _____

10. _____$Pb(OH)_2$ + _____HCl → _____H_2O + _____$PbCl_2$

Type of reaction: _____

11. _____$NaCl$ + _____F_2 → _____NaF + _____Cl_2

Type of reaction: _____

12. _____Pb + _____H_3PO_4 → _____H_2 + _____$Pb_3(PO_4)_2$

Type of reaction: _____

13. _____Ag + _____S_8 → _____Ag_2S

Type of reaction: _____

14. _____CH_4 → _____C + _____H_2

Type of reaction: _____

15. _____$Ca(OH)_2$ + _____H_3PO_4 → _____$Ca_3(PO_4)_2$ + _____H_2O

Type of reaction: _____

Marks
15

Section Assignment 2.4 Part B
Predicting Products and Reactants

Write the complete, balanced equations for the following reactions. (1 mark per question)

1. _____$NaCl$ + _____$AgNO_3$ → _____ + _____$AgCl$

2. Neutralization of hydrochloric acid and sodium hydroxide

   _____

3. _____H_2 + _____ → _____H_2O

4. _____KNO_4 → _____KNO_2 + _____

5. _____ + _____Cu → _____$CuNO_3$ + _____Ag

6. Combustion of magnesium metal

   _____

7. Reaction of iron(III) bromide with copper(I) sulfate

   _____

8. _____Al + _____Fe_2O_3 → _____Fe + _____

9. $HBr + KOH$ → _____ + _____

10. Single replacement reaction of magnesium bromide with chlorine gas

    _____

Marks
10

Section Assignment 2.4 Part C
The Iodine Clock Reaction

The Iodine Clock Reaction is a classic experiment used to demonstrate the effect of a concentration change on the reaction rate.

This experiment starts with the preparation of solution A (contains IO_3^- ions) and solution B (contains HSO_3^- and starch). Solution A and solution B are poured, at the same time, into a test tube.

When solution A and B are mixed, two reactions take place one after another.

Step 1:

$$IO_3^-{}_{(aq)} + 3HSO_3^-{}_{(aq)} \rightarrow I^-{}_{(aq)} + 3SO_4^{2-}{}_{(aq)} + 3H^+{}_{(aq)}$$

Step 2:

$$5I^-{}_{(aq)} + 6H^+{}_{(aq)} + IO_3^-{}_{(aq)} \rightarrow 3I_{2(aq)} + 3H_2O_{(l)}$$

The iodine, I_2, produced in Step 2, will react with starch, turning the colour of the solution to dark blue. You will be timing the duration it takes from mixing the two solutions to the point that the solution turns dark blue.

The experiment is repeated four times. In each successive trial we will dilute solution A. (Note: diluting the KIO_3 solution with distilled water decreases the concentration of KIO_3 present.)

Since the solutions in this reaction would be difficult for you to prepare at home, you will watch a video of each of the four trials. You will need to record the time it takes for the reaction to occur in each trial. (You should record the time when the colour of the solution in the test tube begins to change.)

Preview the "Results" and "Conclusions and Questions" part of the lab and then go to:

Science 10 Media CD > Module 2 > **Iodine Clock Reaction Lab**

Results: Effect of Concentration

Enter your measurements in the table. (2 marks)

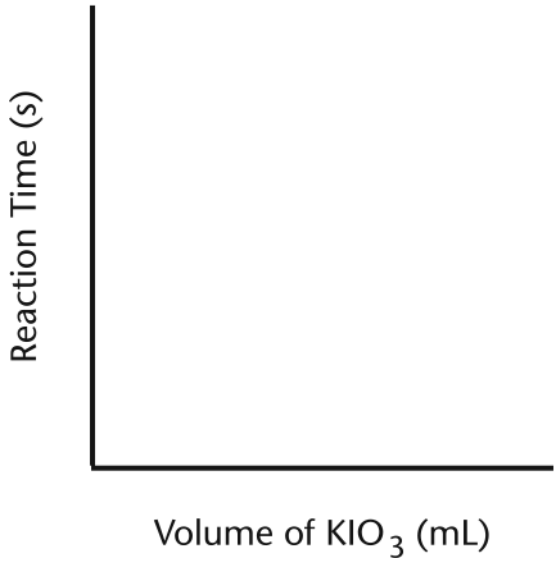
Trial	Volume KIO_3 (mL)	Distilled Water (mL)	Time to Completion (s)
1	10.0	0.0	
2	8.0	2.0	
3	6.0	4.0	
4	4.0	6.0	

Conclusions and Questions

1. Plot your results on a graph. Use the format shown below, but be sure to use graph paper and include an appropriate title and scale. Refer to the SOS package for tips on graphing. (3 marks)

   Go to:

   Science 10 Media CD > SOS package > **Tool #12 Graphing**



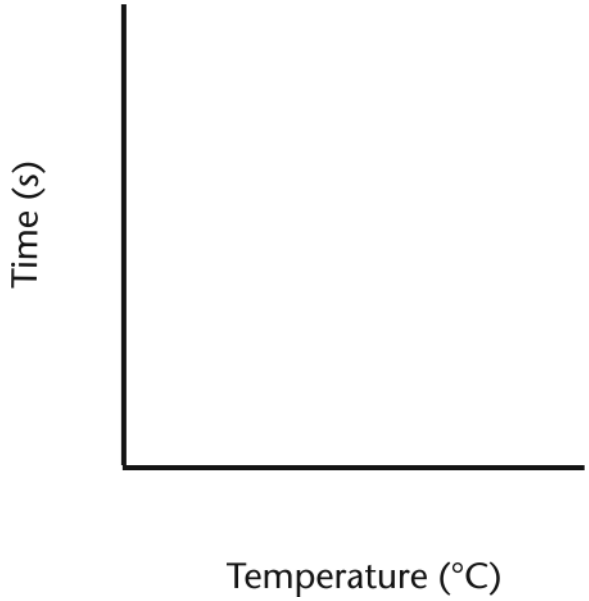
2. From the results of this experiment, what can you say about the relationship between: (3 marks)
   - the concentration of KIO_3 and reaction time?
   - reaction time and rate of reaction?
   - the concentration of KIO_3 and the rate of reaction?

3. Using the collision theory, explain how the change in concentration affected the reaction rate. (3 marks)

4. Suppose you completed the above experiment with the following changes:
   - keep the concentration of both solutions constant
   - change the temperature of the solutions for each trial as shown in the table below

Trial	Volume KIO_3 (mL)	Temperature (°C)
1	10.0	5
2	10.0	15
3	10.0	25
4	10.0	35

A. What do you think the graph of temperature vs. reaction time would look like? Sketch it on the template below. (1 mark)



B. Explain why you sketched the graph the way you did (your explanation should refer to collision theory and reaction rates). (3 marks)

Marks
15

Section Assignment 2.5 Part A
Radioactivity and Nuclear Equations Quiz

1. The **atomic number** of an atom is:
   A. the number of neutrons in the nucleus.
   B. the number of protons in the nucleus.
   C. the number of electrons in the nucleus.
   D. the number of neutrons plus the number of protons.

2. The **mass number** of an atom is:
   A. the number of neutrons in the nucleus.
   B. the number of protons in the nucleus.
   C. the number of electrons in the nucleus.
   D. the number of neutrons plus the number of protons.

3. The correct symbol for plutonium-239 is:
   A. $^{78}_{239}\mathrm{Pt}$
   B. $^{239}_{78}\mathrm{Pt}$
   C. $^{94}_{239}\mathrm{Pu}$
   D. $^{239}_{94}\mathrm{Pu}$

4. An unknown source of radiation can pass through paper, but is absorbed by aluminum foil. The radiation is likely:
   A. alpha particles.
   B. beta particles.
   C. gamma rays.
   D. light rays.

5. The type of reaction that occurs when a large atom splits to form smaller atoms is called:

   A. fission.

   B. fusion.

   C. alpha decay.

   D. beta decay.

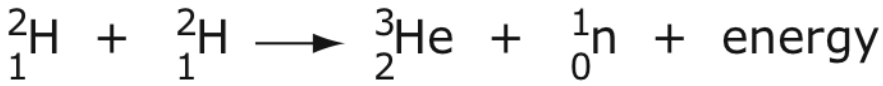
6. Nuclear reactors use carefully controlled fission reactions. Which of the following might be produced by a nuclear reactor?

   A. usable energy

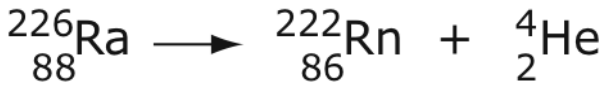
   B. deuterium

   C. an atomic bomb

   D. heavy water

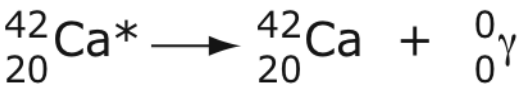
7. 

   A. alpha decay
   B. beta decay
   C. gamma decay
   D. fusion
   E. fission

8. 

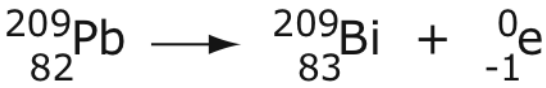
   A. alpha decay
   B. beta decay
   C. gamma decay
   D. fusion
   E. fission

9.



A. alpha decay
B. beta decay
C. gamma decay
D. fusion
E. fission

10.



A. alpha decay
B. beta decay
C. gamma decay
D. fusion
E. fission

Marks
10

Section Assignment 2.5 Part B
Written Response

Answer each of the following questions in complete sentences. Make sure you use appropriate vocabulary and explain fully when asked to do so.

1. Two examples of radioactive decay are given below, but the decay products are missing. For each example, state which type of radioactive decay is occurring and explain how you came to that conclusion. (4 marks)

   A.

   B.

2. You are given a 16 g sample of lead-209. The half-life of this substance is approximately three hours. Answer the following questions relating to the beta-decay of this substance. (3 marks)

   A. What mass of Pb-209 will remain after 3 h?

   B. What mass of Pb-209 will remain after 6 h?

   C. What percentage of Pb-209 has decayed after 9 h?

3. Explain why a nuclear fission reaction will occur more readily than a nuclear fusion reaction. (2 marks)

Marks
9

Section Assignment 2.5 Part C
Experiment: Determining the Half-life

To investigate how radioactive atoms decay, you will complete this simulation. You will use popcorn kernels to represent the nuclei of radioactive atoms. (If you do not have any popcorn kernels, you could use nails, thumbtacks, or another appropriate object.)

You will carry out the investigation and complete the observation chart provided. You will then be expected to graph your results and answer the given questions. The graph can be drawn by hand on graph paper, or computer generated. Make sure you include a title and labels for the axes.

Purpose:

To investigate the activity of a radioisotope over time using popcorn kernels as a model.

Materials:

For this investigation you will need:

- 100 popcorn kernels
- a shallow dish with a lid (make sure the popcorn kernels fit in a single layer on the bottom of the dish)
- a 5 cm strip of masking tape
- graph paper

Procedure:

1. Count out **exactly** 100 popcorn kernels and place them in the dish. These kernels represent 100 nuclei of atoms of a certain radioactive isotope.

2. Place the 5 cm strip of masking tape along one edge of the dish.

3. Cover the dish and shake it well.

4. Uncover the dish. Count and remove all of the kernels that are **pointing towards the strip of tape**. These "nuclei" have "decayed." Record the number of kernels (decayed nuclei) removed in your chart.

5. Once again, cover the dish with the remaining, undecayed nuclei, and shake it well.

6. Uncover the dish. Again, count and remove all of the kernels that are pointing towards the strip of tape (decayed nuclei). Record the number of kernels (decayed nuclei) removed in your chart.

7. Repeat steps 5 and 6 until all of the kernels are gone. In this model, each shake represents the passing of a certain period of time. Even if you do not remove any kernels, the shake still counts as a time interval, and must be recorded.

8. Using the data you collected, create a graph. Plot the **number of original nuclei remaining** on the vertical axis and **time (shakes)** on the horizontal axis. Do not forget to label the axes and provide a title for your graph. Refer to the SOS package for tips on graphing.

   Go to:

   Science 10 Media CD > SOS package > **Tool #12 Graphing**

9. Using your results and the graph you created, answer the questions.

Observations:

(Complete the chart based on your observations.)

Time (shakes)	Number of Decayed Nuclei	Number of Original Nuclei Remaining
1	0	100
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Questions:

1. Look at the graph you created. How many shakes did it take for the original number of nuclei to reduce from:
   A. 100 to 50
   B. 50 to 25
   C. 25 to 12 or 13

2. With each shake, did the **number** of nuclei that decayed in increase, decrease, or stay the same? (Refer to your observations chart and your graph.)

3. With each shake, did the **rate** of decay in increase, decrease, or stay the same? (Hint: consider the proportion of nuclei that decayed with each shake.)

4. Use your results to determine the half-life of your radioactive popcorn.

5. Imagine repeating this experiment. If you changed the piece of masking tape, using a 1 cm strip instead of a 5 cm strip, how would this affect the rate of decay? Predict what would happen to the half-life of the sample.

Marks

Marking Guidelines

Description	Score
Table of results (complete)	2
Graph (title, labelled axes, appropriate scale)	5
Questions (one mark each for correct and complete answers)	5
Total:	12