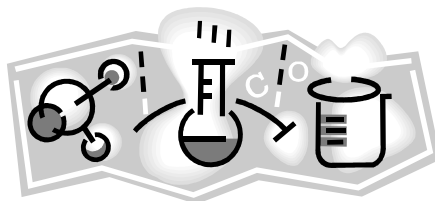


# Physical Science 556-416

LaurenHill Academy  
Mid-year Exam  
January 2005



Instructions:

1. Allowed materials: Non-graphing calculator, and included periodic table (found at the end of the answer booklet—feel free to rip it out for your convenience).
2. Answer all questions in the answer booklet provided. See more detailed instructions within each section.

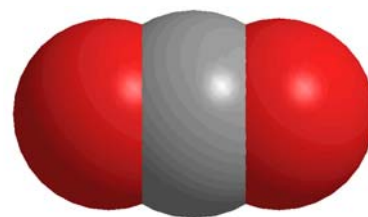
This questionnaire should have 13 pages, including this cover.

**Time: 2 hours**

**PART I**      **MULTIPLE CHOICE: Answer all 40 questions on the answer sheet provided in Part 1 of the answer booklet. Darken the letter corresponding to the correct answer. (2 marks each)**

1. Which of the following is an element?
  - A) air
  - B) boron
  - C) carbon dioxide
  - D) salt water
  
2. Which statement concerning solutions is **TRUE**?
  - A) Solutions have to be mixtures of different elements
  - B)  $\text{NaCl}_{(l)}$  is an example of a solution.
  - C) Throughout a solution, the composition and properties vary.
  - D) A solution is homogeneous but not pure.

3. Which is a *characteristic* property of carbon dioxide?
  - A) It is a colourless, odourless gas.
  - B) It is a chemical compound.
  - C) A flaming splint quickly dies out in its presence.
  - D) Limewater turns milky in its presence.



4. A student carried out various tests on four substances labeled W, X, Y and Z. Her results are summarized in the table below:

<b>Table of Results</b>					
<b>Substance</b>	<b>Color</b>	<b>Density (g/L)</b>	<b>Melting Point</b>	<b>Boiling Point</b>	<b>Reaction with HCl</b>
<b>W</b>	White	1.630	80.1	326.6	Fizzing occurs
<b>X</b>	Light yellow	1.742	81.3	340.2	Dissolves immediately
<b>Y</b>	White	2.123	65.2	285.4	Fizzing occurs
<b>Z</b>	Light gray	1.627	80.3	327.3	Fizzing occurs

Which of the above two are most likely to be the same substance?

- A) W and X
- B) W and Z
- C) X and Y
- D) Y and Z

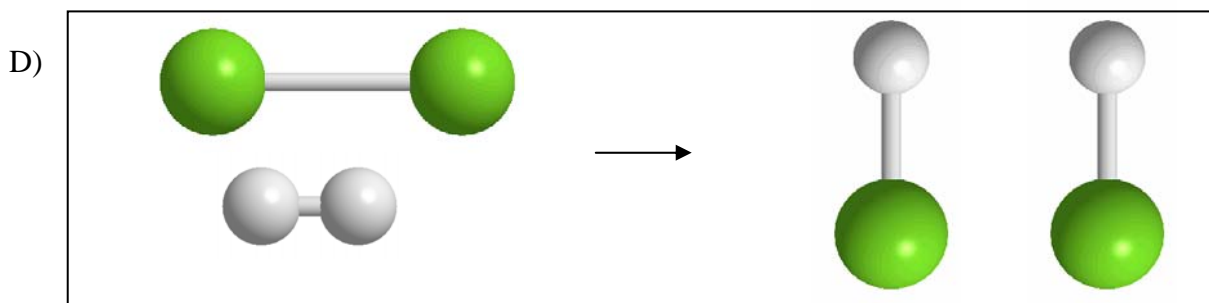
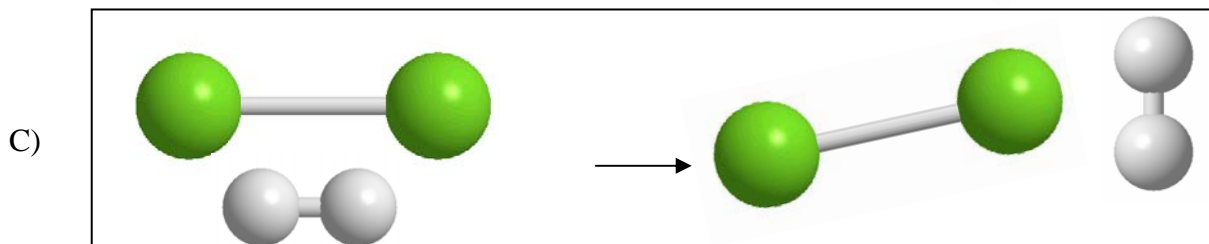
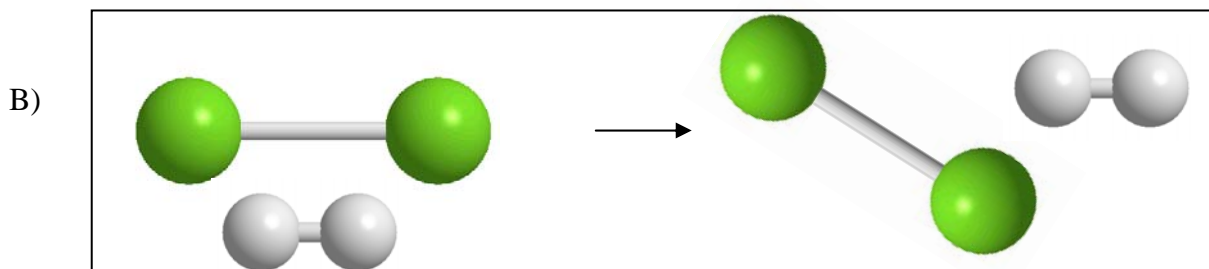
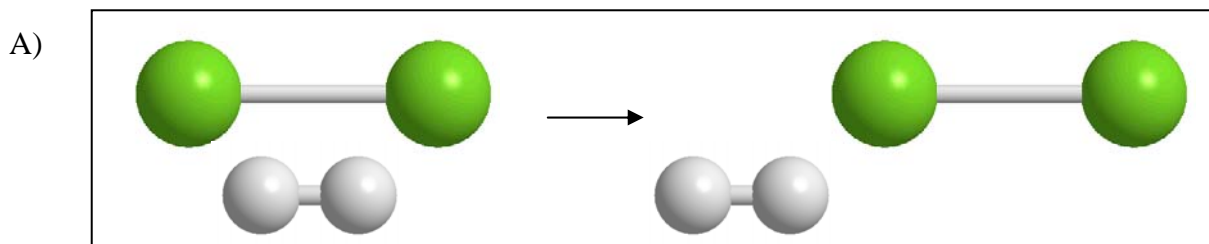
5. In a certain reaction, we notice the formation of an element different from the one found among the reactants. In general, this is true for \_\_\_\_\_.

- A) some chemical reactions.
- B) all chemical reactions.
- C) some physical reactions.
- D) all physical reactions.

6. Which represents a **chemical** change?

- A) Rain droplets formed from a cloud.
- B) Rubbing alcohol evaporated after being applied on skin.
- C) Ink was absorbed by paper .
- D) Roast beef was cooked in the oven.

7. Which of the following represents a **chemical** change?



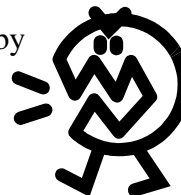
8. A student heated two black powders(charcoal and copper oxide) with a total mass of 4.5 g. After about five minutes, a brownish-red substance formed at the bottom of the test tube. The mass of the products, excluding the gas that was released, was 4.0 g.

Which of the following statements are TRUE?

1. The decrease in mass suggests that a compound decomposed.
2. The colour change suggests a physical change.
3. The mass should have increased if the experiment was done properly.
4. Copper oxide turned into copper.

- A) 1 and 2  
B) 1 and 4  
C) 2 and 3  
D) 3 and 4

9. All attempts to decompose a certain substance into anything simpler by a variety of methods were unsuccessful. This indicates that the substance is most likely a(n)....



- A) compound  
B) element  
C) heterogeneous substance  
D) solution

10. Thomson's experiments revealed that the electron was not a form of light. Electrons were shown to have.....

- A) mass and negative charge.  
B) mass and positive charge  
C) no mass and negative charge  
D) no mass and positive charge

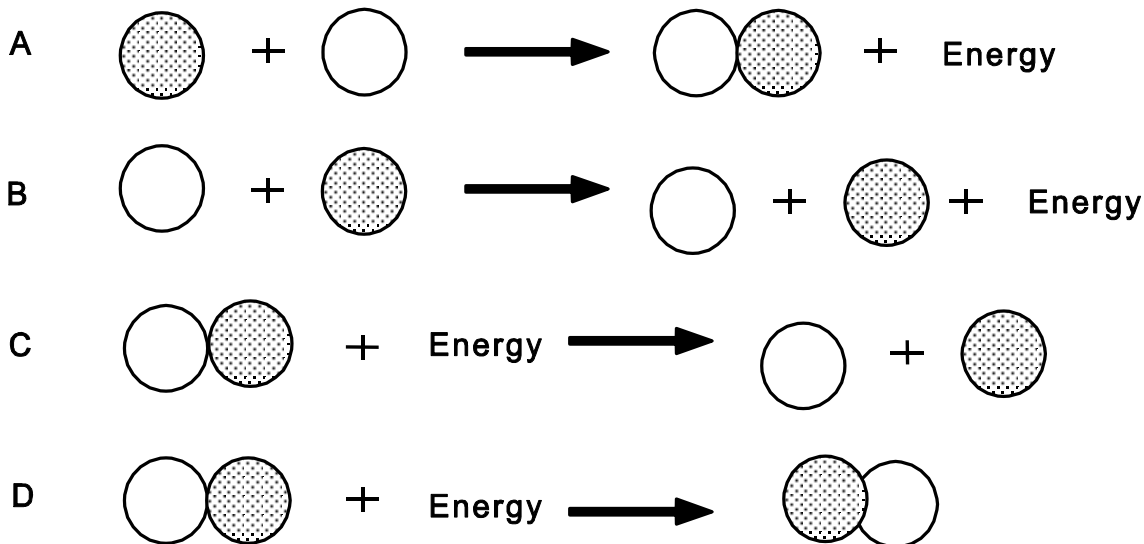
11. When Rutherford fired alpha particles at a gold leaf, a few of the alpha particles were deflected, but most went right through the foil. This implied that:

- A) The atom is surrounded by positive particles.  
B) The center of the atom is mainly empty space.  
C) The mass and positive charges are concentrated in the center of the atom.  
D) The mass of the atom is distributed evenly throughout the atom.

12. Which of the following lists the models of the atom in **chronological** order?

- A) Dalton, Democritus, Rutherford, and then Thomson
- B) Thomson, Democritus, Dalton and then Rutherford
- C) Democritus, Dalton, Rutherford and then Thomson
- D) Democritus, Dalton, Thomson and then Rutherford

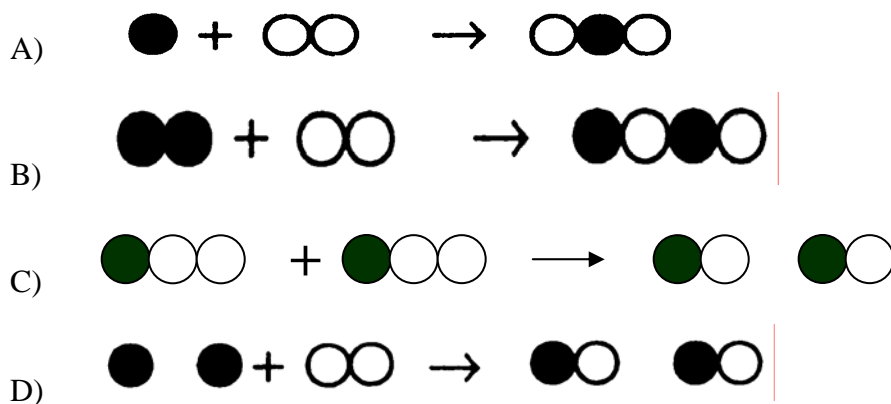
13. Which of the following illustrates the formation of a compound from its elements?



14. The incomplete combustion of carbon, C, in an environment containing little oxygen gas, O<sub>2</sub>, produces a toxic gas called carbon monoxide, CO.

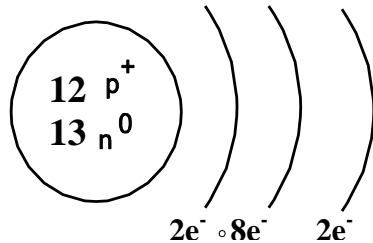
This reaction is represented by the equation:  $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$

Which of the following models correctly represents this reaction?

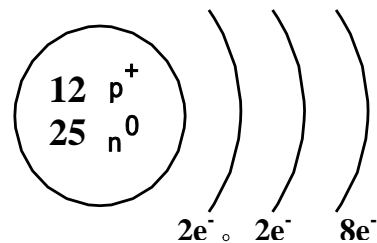


15. Which of the following best represents the magnesium ( $^{25}\text{Mg}$ ) isotope according to the Rutherford-Bohr model?

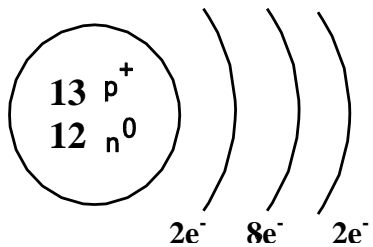
A)



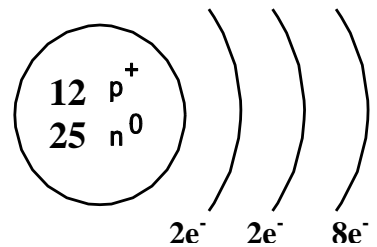
C)



B)



D)

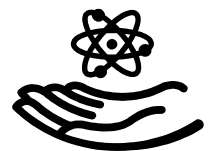


16. If a Bohr-Rutherford diagram is drawn for  $\text{F}^{-1}$ , how many electrons will we find in the *second* energy level (shell)?

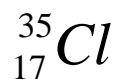
- A) 0  
 B) 2  
 C) 7  
 D) 8

17. Three isotopes of cesium are  $^{134}\text{Cs}$ ,  $^{135}\text{Cs}$  and  $^{137}\text{Cs}$ . These isotopes are alike in that all three have the same....

- A) atomic number.  
 B) mass number.  
 C) number of neutrons.  
 D) physical properties.



18. Given the following information:



Which reveals the correct number of protons, neutrons and electrons?

	<b>protons</b>	<b>neutrons</b>	<b>electrons</b>
A	17	17	17
B	17	18	17
C	35	17	18
D	35	18	18

19. I am a **period 4**-element with chemical properties similar to those of Be. What element am I?
- A) Al  
 B) Ca  
 C) Mg  
 D) Sc
20. Chemical families consist of elements that share certain properties. Which of the following statements concerning chemical families is **FALSE**?
- A) Alkali metals have two valence electrons.  
 B) Alkaline earth metals react with water.  
 C) The halogens easily react with alkali metals.  
 D) The noble gases are not very reactive.
21. From the elements listed below, which group consists of only non metals?
- A) Be, Mg, Ca, and Ba  
 B) N, P, S, Cl  
 C) C, Si, Ge, As  
 D) Xe, He, Ne, and Te

22. Which of the following is a property of metals?
- A) Many of them react with nonmetals.  
 B) They are poor conductors of heat.  
 C) They are poor conductors of electricity.  
 D) They rarely react with acids.
23. From *left to right* in the periodic table, the elements are arranged in the following order:
- A) Inert(noble) gases, non-metals, metalloids, metals  
 B) Non-metals, inert(noble) gases, metalloids, metals  
 C) Metals, non-metals, metalloids, inert(noble) gases  
 D) Metals, metalloids, non-metals, inert(noble) gases

24. Which of the following *correctly* represents the symbols of the given elements?

	<b>Sulfur</b>	<b>Calcium</b>	<b>Phosphorus</b>	<b>Nitrogen</b>
A)	Sr	C	K	Ni
B)	Sr	C	K	N
C)	S	Ca	P	Ni
D)	S	Ca	P	N

25. What is the correct formula for sodium oxide?
- A) NaO  
 B) Na<sub>2</sub>O  
 C) Na<sub>2</sub>O<sub>2</sub>  
 D) NaO<sub>2</sub>
26. How many atoms of carbon, nitrogen and oxygen respectively are there in a molecule of the explosive, C<sub>8</sub>(NO<sub>2</sub>)<sub>8</sub>?

	<b>C</b>	<b>N</b>	<b>O</b>
<b>A)</b>	8	8	16
<b>B)</b>	64	8	16
<b>C)</b>	64	1	2
<b>D)</b>	16	9	10



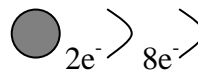
27. An unknown ion, X, has a charge identical to that of Mg's common ion. What compound will it form with  $P^{-3}$ ?

- A) XP
- B)  $X_2P$
- C)  $X_3P$
- D)  $X_3P_2$

28. Which compound is *incorrectly* named?

- A)  $NO_2$ : nitrogen dioxide
- B) KOH: potassium hydride
- C) KCl: potassium chloride
- D)  $O_{2(g)}$ : oxygen gas

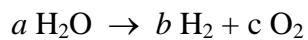
29. An atom that was originally neutral gained 3 electrons. As a result of *gaining* three electrons, the atom has the following shell-diagram:



What was the *original* atom?

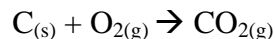
- A) neutral nitrogen
- B) nitrogen with a charge of -3
- C) neutral boron
- D) boron with a charge of +3

30. What is the sum of the coefficients *a*, *b*, and *c* when the following equation is **correctly** balanced?



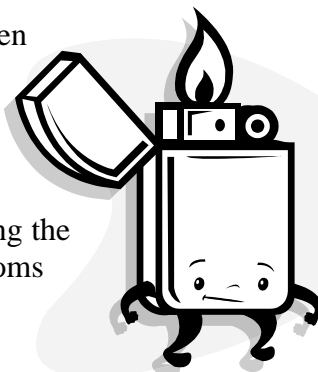
- A) 3
- B) 4
- C) 5
- D) 6

31. If 24 grams of charcoal react with 64 grams of oxygen, how much carbon dioxide will be produced?



- A) 0 grams, since a gas cannot be weighed  
 B) 24 grams, since the mass of the element will not change  
 C) 64 grams, since the mass of the gas will be the same as that of the reactant-gas  
 D) 88 grams, since the mass of the product will equal that of the reactants

32. The reaction caused by the burning of butane in air is given below:



If the coefficients in the above equation are interpreted as being the number of molecules, what is the total number of oxygen atoms among the reactants? Among the products?

- |    | <b>Reactants</b> | <b>Products</b> |
|----|------------------|-----------------|
| A) | 13               | 10              |
| B) | 15               | 20              |
| C) | 26               | 26              |
| D) | 52               | 72              |

33. What coefficient belongs in front of H<sub>2</sub>O to create a balanced equation in the following reaction?



- A) 1  
 B) 3  
 C) 6  
 D) 10

34. A student dissolves 30.0 g of solute in 275 ml of solution. What is the concentration of the solution?

- A) 0.00917 g/L  
 B) 0.109 g/L  
 C) 9.17 g/L  
 D) 109 g/L

35. Two ways of **increasing the concentration of** a solution of NaBr are:

- A) add more NaBr or add water
- B) remove NaBr or remove water
- C) remove both NaBr and water
- D) add more NaBr or evaporate some water

36. Andrew is preparing a drink from concentrated fruit juice.

His original concentrate has a volume of 250 mL, and its concentration is 16 g/L. He adds 750 mL of water. What is the new concentration of the juice?



- A) 4.0 g/L
- B) 5.3 g/L
- C) 48 g/L
- D) 64 g/L

37. In which of the following solutions is alcohol a solute?

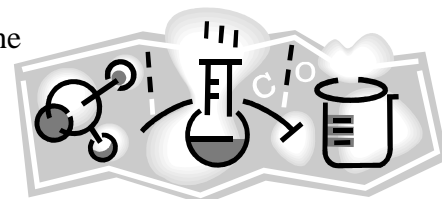
- A) adding 20 g of acetone dissolved in 80 g of alcohol.
- B) A mixture with 70 g of alcohol and 30 g of water.
- C) A solution consisting of 80% alcohol.
- D) A solution consisting of 20% alcohol.

38. What is the concentration of a sugar solution, in g/L, that contains 3 kg of sugar in 3000 L of water?

- A) 0.000001 g/L
- B) 1.0 g/L
- C) 1000 g/L
- D) 0.001 g/L

39. You need 300.0 mL of a sodium chloride (NaCl) solution having a concentration of 15 g/L.

Which of the following methods can best be used to obtain the required solution?



- A) Dissolve 1.5 g of NaCl in 50 mL of water and then add water to obtain a final volume of 300 mL.
- B) Dissolve 4.5 g of NaCl in 100 mL of water and then add water to obtain a final volume of 300 mL.
- C) Dissolve 15 g of NaCl in 150 mL of water and then add water to obtain a final volume of 300 mL.
- D). Dissolve 45 g of NaCl in 200 mL of water and then add water to obtain a final volume of 300 mL.

40. Which of the following *does not* produce an electrolyte when added to water?

- A. NaOH  
 B. HCl  
 C. CH<sub>4</sub>  
 D. NaI

**PART II (Show Work)**

41. A silvery piece of metal is placed into a flame. Soon, an intense white light is produced, and a white powder remains on the tongs used to hold the metal.
- What two observations suggest that a chemical change occurred?
  - What two things can be done to provide more evidence that this was indeed a chemical change?
42. List two laboratory tests that can be used to distinguish between a silvery piece of silicon and a silvery piece of zinc(Zn).
43. The four periodic table families we have studied are listed in the table provided in the answer booklet. Fill in the blanks on the answer sheet with their common charge and mention what substances they react with.
44. **Translate** the following equation into a word equation
- $$\text{Mg(OH)}_{2(\text{aq})} + \text{Na}_2\text{S}_{(\text{aq})} \rightarrow 2 \text{NaOH}_{(\text{aq})} + \text{MgS}_{(\text{s})}$$
45. How would you prepare 250.0 mL of a 3.0 g/L aqueous solution of NaOH?
- Show all calculations and outline a procedure that you would use in the lab.

