## Secondary Cycle 2, Year Two

**( In plain English, grade 10)**
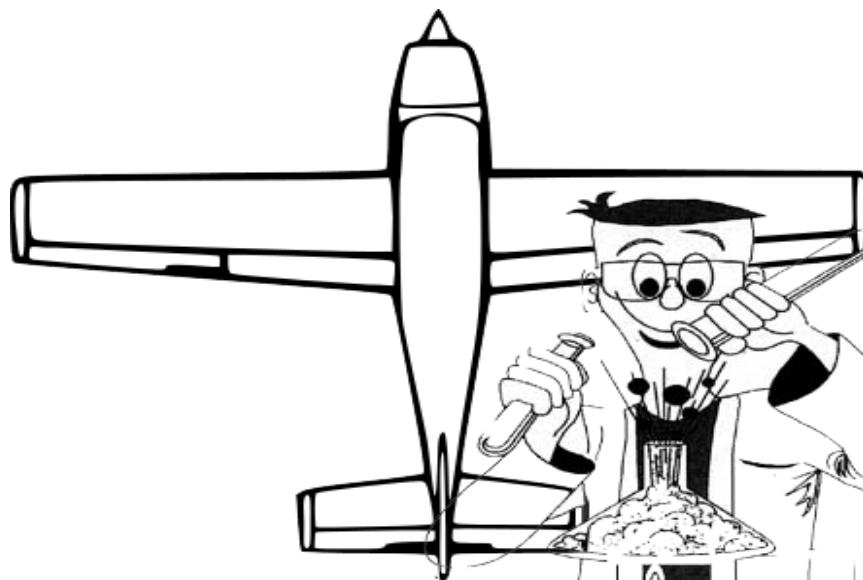
## January 2013

## ST (Sec. 4)

# Theory Examination

## Combined Question and Answer Booklet
### (We lower your eco-foot print by putting it all into one!)



**Answer all 15 multiple questions on the questionnaire and then transfer them to the answer sheet when it's given to you at the end of your exam.**

**Answer questions 16 to 26 on this questionnaire.**

Name: _____

Group: _____

Time: 2.0 hours

**Section 1**      **Multiple Choice**

**Instructions**:   For each question, circle **_one_** letter corresponding to the best answer on the answer sheet.

1. Which of the following statements is FALSE?

   (A) All matter is made up of small, indivisible particles called atoms.
   (B) All carbon atoms in the world have the same number of protons.
   (C) Elements can bond with others to form compounds.
   (D) Chemical reactions do not create new substances.

2. Which of the following is a characteristic property of gold?

   (A) It is a shiny metal.
   (B) It is a good conductor of heat and electricity.
   (C) It is the most malleable of all the metals.
   (D) It can be used to treat rheumatoid arthritis.

3. Match the following clues with the appropriate family:
   I.     A very reactive substance with a tendency to take electrons from metals
   II.    A substance that should be stored in oil because it reacts violently with water
   III.   A substance that normally has 8 valence electrons
   IV.   Substances that are found in dairy products which can help fortify bones and teeth.

   |       | I           | II            | III       | IV             |
   |-------|-------------|---------------|-----------|----------------|
   | (A)   | Halogen     | alkali metal  | halogen   | Alkali metal   |
   | (B)   | Halogen     | alkali metal  | noble gas | alkaline earth |
   | (C)   | Alkali Metal| alkaline earth| halogen   | halogen        |
   | (D)   | Alkali metal| halogen       | noble gas | alkaline earth |

4. What is the sum of all the coefficients($a + b + c$ )when the following equation is balanced? (a coefficient is a big number in front of the chemical formula)

   $a$ Ca + $b$ P → $c$ Ca$_3$P$_2$

   (A) 6
   (B) 7
   (C) 8
   (D) 12
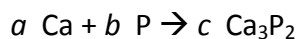
5. The bacteria *Bacillus thuringiensis(Bt)* thrives in alkaline(basic) environments and releases a protein that attacks intestinal cells. When these are killed, the cells release their nutrients and the bacteria feed off them. Which of the following organisms are most likely to be attacked by *Bt* bacteria?

| ANIMAL | Average pH of intestines |
|---|---|
| human | 5.7 to 7.4 |
| starving dog | 7.2 |
| Moth | 8.3 to 11.7 |
| mosquito | 6.0 to 7.5 |

(A) Humans and dogs
(B) moths
(C) mosquitoes
(D) humans, dog and mosquitoes whose guts have pH's < 7

6.  In drawing a Lewis structure for oxygen, how many dots do we place around the O?

    (A) 5
    (B) 6
    (C) 7
    (D) 8

7.  Which of the following does NOT contain a total of 18 electrons?

    (A) $S^{-2}$
    (B) $Cl^{-1}$
    (C) Ar
    (D) Ca

8.  What must happen to solid salt for it to conduct electricity?

    (A) It dissolves in water and then ions move towards positive and negative electrodes.
    (B) It can only happen if it first turns to liquid.
    (C) It dissolves in water and only positive ions move.
    (D) It dissolves in water and only negative ions move.

9.  Which of the following involves a reaction between solutions?

    (A) Wood burning in a fireplace.
    (B) Aqueous baking soda reacting with excess acid in the stomach.
    (C) Iron on a car rusting.
    (D) Paint drying on the wall.

10. What is the m/V % of a solution created by dissolving 2.0 grams of sugar per 250 ml of solution?

    (A) 0.8 %
    (B) 8 %
    (C) 80 %
    (D) 800 %

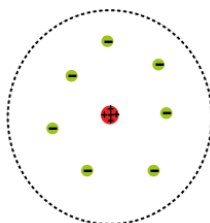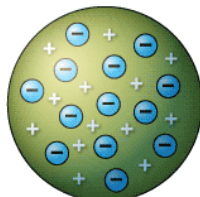11. Which of the following is the Thomson model of the atom?

(A)
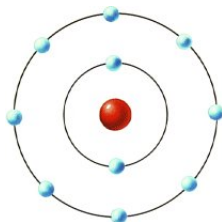
(B)
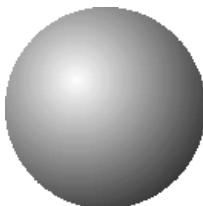
(C)

(D)

12. Wind turbines are on average 40% efficient? What does that mean?

(A) Out of 1000 kJ of wind energy, we will obtain 40 kJ of electricity.
(B) Out of 1000 kJ of electricity, we will obtain 40 kJ of wind.
(C) Out of 50 kJ of wind energy, we will obtain 20 kJ of electricity.
(D) Out of 50 kJ of electricity, we will obtain 20 kJ of wind.

13. In about 25 hours, there are_____low tides and _____high tides.
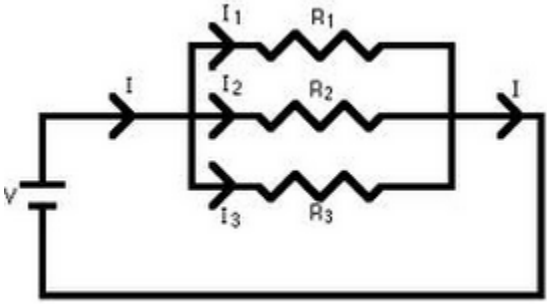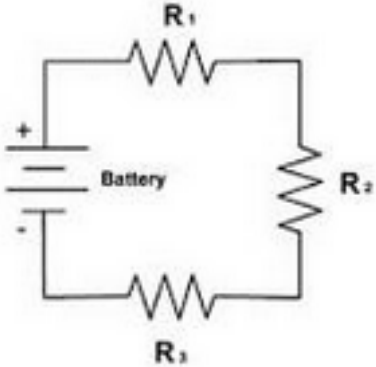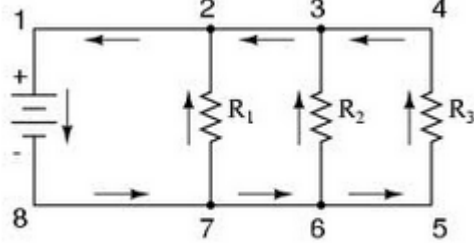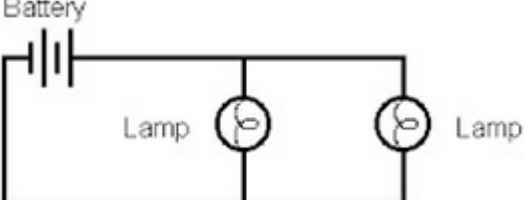(A) 1,1
(B) 1,2
(C) 2,1
(D) 2,2

14. What part of the atom is rubbed off to create static electric, for example when a balloon is rubbed on someone's hair?
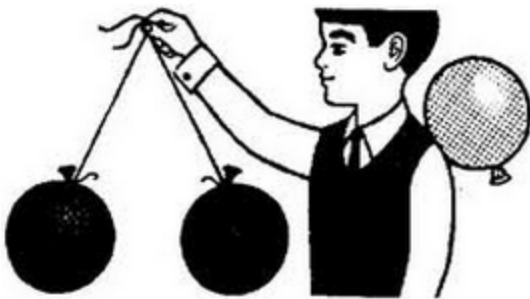
(A) Electrons
(B) Protons
(C) Neutrons
(D) Either protons or electrons

15. Which circuit is **not** parallel? (not on this year's midterm)

| | |
|---|---|
| (A)  | <br>(B) |
| <br>(C) | (D)  |

**Part 2 Questions 16→26:**   Show the work. (5 marks each, unless indicated otherwise)

16. a)  Potassium chlorate, $KClO_3$, decomposes to form potassium chloride, KCl, and oxygen gas.  Write the balanced equation for this decomposition reaction. (2 marks)

$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

b) If 245 grams of $KClO_3$ produce 149 grams of KCl, how much oxygen will also be produced? (2 marks)

x  = 254g – 149g = 95 g

c) Why? (1 mark )

Mass is conserved in chemical reactions.

17. a) Draw a Bohr-Rutherford model of nitrogen(N). Label the protons, electrons and energy shells. (3 marks)

(7p)  $2e^-)5e^-$ )                    ) for electrons = shell

b)  Draw a Lewis dot structure for nitrogen (N). (2 marks)

Place 5 dots around the N atom.

18. Fill in the blanks. (1 mark each)

a)  The alkali metal with the least number of protons is ____Li_

b)  The family whose relatively unreactive members do not react with metals is the___noble gas_____family.

c)  The__halogen_ family includes the gas that can react with sodium to create salt.

d)  The _____alkaline earth_____family's members are higher melting metals than atoms like Li and Na, and they include ions found in seashells .

e)  The gas, ____H___, whose atoms have a valence of 1 does not belong to the alkali metals family.

19.    0.019 grams of sodium bromide are dissolved in 100 ml of solution.

   a)  Express the concentration in g/L. (3 marks)

       0.019g/0.100 L = 0.19g/L

   b)  Express the concentration in ppm. (2 marks)

       0.19g/L = 190 mg/L
       = 190 ppm

20. A soda factory accidentally lowered the concentration of sugar in a 2000 L of a 50g/L solution to 37 g/L. How much water was accidentally added to the 50 g/L solution?

$$C_1V_1=C_2V_2$$

(50g/L)( 2000 L) = (37 g/L) $V_2$
$V_2$ = 2703 L

So we had $V_1$+x = $V_2$.
2000 L + x =  2703 L
We added 2703 – 2000 = 703 L

21. Use water as an example to explain how the temperature of a substance can be high without containing much heat, and how a substance at a lower temperature can contain more heat.

    Make sure you define both heat and temperature in your explanation.

    Heat is _____a form of energy that depends on both movement of molecules and the quantity (mass ) of molecules at a specific temperature (2 marks)

    Temperature is proportional to the kinetic energy of molecules ( related to how fast they're moving._____
    _____(
    1 mark )

    A n example of how the temperature of a substance can be high without containing much heat is….. (1 mark) _____a drop of boiling water_____
    _____

    A n example of how the temperature of a substance can be lower while containing more heat is….. (1 mark)
    _____
    _____the heat contained by the water in a room's large radiator which is lower than boiling temperature
    _____

22.  a) A current of 100 mA flows through a circuit. Its resistance is 80 Ω. What is the voltage of the power supply?                                        (3 marks )

     V = IR
     = 0.100 A(80 Ω) = 8 V

     b) If we use the same resistors as in part(a) but change the voltage to 3.0 V, what current will flow through the circuit?                          (2 marks )

<mark>I = V/R = 3.0 V /80 Ω. = 0.0375 A</mark>

23. On the "before" side of the diagram, we are not showing a charged rod that came close to one of the spheres. (1 mark each )
    a) In the "before" box, draw where the rod had to be placed to create the change shown. <mark>On the left hand side</mark>
    b) Show the rod's charge, if any. <mark>negative</mark>
    c) What particles moved from one sphere to the other? <mark>electrons</mark>
    d) What was the charge of the particles that moved from one sphere to the other? <mark>negative</mark>

    e) Indicate the direction of movement of particles from one sphere to the other. <mark>Left to right</mark>



BEFORE                    AFTER
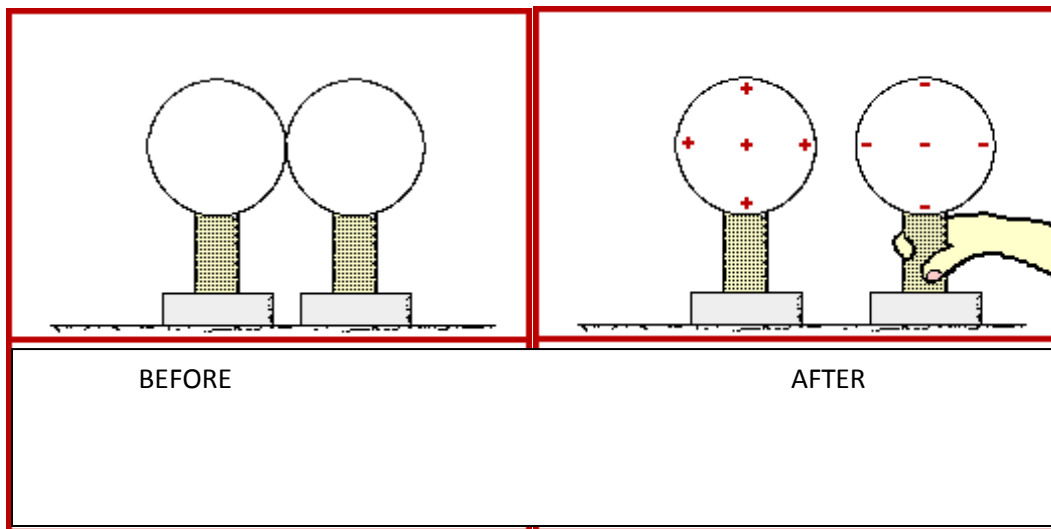
<mark>Not on this year's exam:</mark>
24.    a) Which switches should be turned on to get only L3 to work? (1 mark )

    b) Redraw the parallel circuit to show how one single switch could either turn all lights on or off. (2 marks )
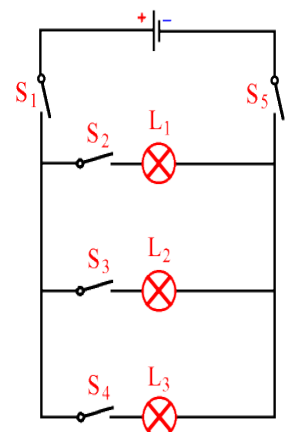
c)        Draw a series circuit with L1, L2 and L3, a power source and a voltmeter measuring L1's voltage. (2 marks )

Not on this year's exam either: 25 and 26

25.        A 500 W kettle is used for 20 minutes a day. How many kJ of energy does it consume in one month (30 days)?

26.        The resistance of a heater sold on amazon.ca is 20 $\Omega$. Its voltage is 120 V. Find its power in watts.