Secondary Cycle 2, Year Two

(In plain English, grade 10)

January 2013

EST-400.A01 (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. But do questions 16-26 on the questionanire

Name: _____

Group: _____

Time: 2.5 hours

Section 1 Multiple Choice **(3 marks each)**

Shade in the letter corresponding to the best choice on this questionnaire.

1. Which of the following is the correct notation for an atom with 8 protons, 10 electrons and 9 neutrons?

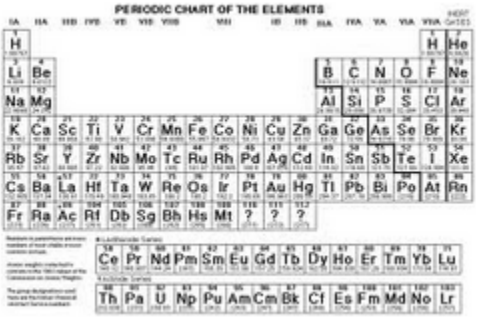
   (A) $^{16}O^{2-}$
   (B) $^{16}O^{2+}$
   (C) $^{17}F^{-}$
   (D) $^{17}O^{2-}$
   (E) $^{17}F^{2-}$

2. If ^{13}N is radioactive and reacts with oxygen at high temperatures, which of the following is most likely to be ***FALSE*** about other isotopes of nitrogen?

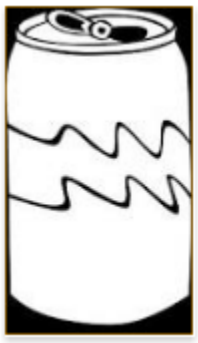
   (A) ^{14}N also reacts with oxygen at high temperatures.
   (B) Nitrogen gas containing ^{15}N has a higher density than gas with ^{13}N.
   (C) Other isotopes of nitrogen have different mass numbers.
   (D) ^{15}N also has to be radioactive.

3. Which of the following statements concerning trends is TRUE?

   (A) Nitrogen has a larger atomic radius than lithium.
   (B) Oxygen is more electronegative than fluorine.
   (C) Neon has a lower ionization energy than fluorine.
   (D) Sodium has a lower melting point than lithium.



4. When the following equation, representing the neutralization of dark soda's phosphoric acid by calcium hydroxide(limewater), is balanced the sum of the coefficients, a, b , and c will equal_____?



__a__ $H_3PO_{4(aq)}$ + __b__$Ca(OH)_{2\ (aq)}$→ $Ca_3(PO_4)_{2\ (s)}$ + __c__H_2O

(A) 11
(B) 12
(C) 13
(D) 14

5. If an unknown metal, Q, from calcium's family reacts with an unknown non metal, X, from chlorine's family, then the compound will have which empirical formula?

(A) QX
(B) Q_2X
(C) QX_2
(D) QX_3

6. Based on its Lewis structure, which of the following will **share two of its valence electrons** with another atom of its kind to form a **double bond**?

(A) C
(B) N
(C) O
(D) F

7. Some compounds that are found in your home include potassium iodide(added to salt), silicon dioxide(in glass), calcium sulfate(in gyprock of your walls), and sodium hydroxide(in oven cleaner). What are the correct formulas for these compounds?

(A) KI, SiO_2, $CaSO_4$, NaOH
(B) KI, SiO_2, $CaSO_3$, NaOH
(C) KI, SiO_2, $CaSO_4$, Na_2O
(D) KI_2, Si_2O, $CaSO_4$, Na_2O
(E) KI_2, Si_2O, $CaSO_3$, NaOH

8. Which of the following corresponds to the nuclear composition and electron arrangement of ^{41}Ca?

(A) 20p, 21n 2e)8e)8e)2e
(B) 21p, 20n 2e)8e)8e)2e
(C) 20p, 21n 2e)8e)10e
(D) 21p, 20n 2e)8e)10e

9. Which of the following will **NOT** have the **same number of atoms** as 12.000 grams of ^{12}C?

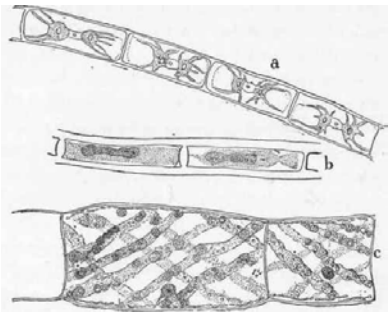
(A) 6.02×10^{23} atoms of Si
(B) 23 g of Na
(C) 6.02×10^{23} molecules of O_2
(D) 1.0 g of H_2

10. How many grams of NaOH will be left over if a 10.0 ml sample of a 0.50 mol/L solution evaporates?

(A) 0.005
(B) 0.2
(C) 200
(D) 400

11. The algae in water average 0.03 ppm of a certain toxin, whose molar mass is 120 g/mole. If the bioconcentration factor is 25, what is the concentration of that toxin in the water itself? Express your answer in moles of toxin per liter of aqueous solution.

(A) 1.0×10^{-8} mol/L
(B) 1.0×10^{-5} mol/L
(C) 1.0×10^{-2} mol/L
(D) 1.0×10^{-1} mol/L



12. What causes a society to **increase** its ecological footprint?

(A) Inefficient use of water and resources
(B) Inefficient use of energy and resources
(C) Efficient use of water and resources
(D) Efficient use of energy and resources

13. Which of the following will be a weak electrolyte?

(A) $NaOH_{(aq)} \rightarrow Na^+ + OH^-$
(B) $HCl_{(aq)} \rightarrow H^+ + Cl^-$
(C) $NaBr_{(aq)} \rightarrow Na^+ + Br^-$
(D) $CH_2O_2 \rightleftharpoons H^+ + CHO_2^-$

14. Which of the following is a fusion reaction?

(A) ${}^{40}_{19}K \rightarrow {}^{40}_{20}Ca + {}^{0}_{-1}e$

(B) ${}^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th + {}^{0}_{0}\gamma$

(C) ${}^{3}_{2}He + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + {}^{0}_{1}e$

(D) ${}^{12}_{7}N \rightarrow {}^{12}_{6}C + {}^{0}_{1}e + \nu$

15. Which has the biggest weight?

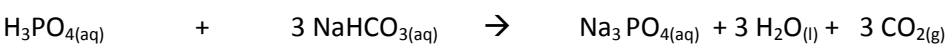
(A) A 3.5 kg mass on the earth where g = 9.81 N/kg
(B) An 18.06 kg on the moon where g = 1.63 N/kg
(C) 20 N weight
(D) 1810 g on the moon where g = 1.63 N/kg

Section 2 Show all work. (5 marks each)

16. Draw the appropriate Lewis structure for each of the following chemical formulas, keeping in mind that one or more of the compounds may be ionic. (a,b,c = 1 mark; d = 2 marks)

a) CH_2O	b) K_2O
c) $MgBr_2$	d) CH_3NH_2

17. 294 000 g of phosphoric acid ($H_3PO_{4\ (aq)}$) have been spilled into a small pond. The acid was neutralized with $NaHCO_3$ according to the following reaction:



$$H_3PO_{4(aq)} + 3\ NaHCO_{3(aq)} \rightarrow Na_3\,PO_{4(aq)} + 3\ H_2O_{(l)} + 3\ CO_{2(g)}$$

It took 4500 L of sodium hydrogen carbonate solution ($NaHCO_{3(aq)}$) to eliminate the acid.

What was the concentration in g/L of $NaHCO_{3(aq)}$ that was added to the pond in order to neutralize all of the spilled phosphoric acid?

Answer:_____

18. Neon has two major isotopes, ^{20}Ne and ^{22}Ne.

90% is ^{20}Ne and the rest is ^{22}Ne.

What is the approximate average atomic mass of neon?

Answer:_____

19. The pH of a solution was originally 7.8. Without buffer, a small amount of acid made the concentration of H^+ increase by a factor of 100. Find the new pH of the solution. Show work.

20. When 2 moles of hydrogen bromide are formed, the reaction releases heat to its surroundings according to the following equation:

$H_2 + Br_2 \rightarrow 2\ HBr + 103\ kJ$

How many kJ will be released if 8.1 g of HBr are formed?

21. In a liter of a certain solution there are 2.0 g of $K_2Cr_2O_7$. We then add 300.0 ml of water. Calculate the molarity of the diluted solution.

22. The lethal dose for heroin is 22 mg/kg. A 78 kg addict injected himself with such a dose. Each syringe usually contains on average 429 mg of heroin. How many fresh needle marks were found on the addict's arm by the coroner (how many times did the addict recently inject himself with a syringe)?

23. What is the specific heat of a substance with a mass of 250.0 g and which requires 5.25 kJ to raise its temperature by 15.0 ^{o}C?

24. Classify as exothermic or endothermic.

a) $CH_4 + O_2 \rightarrow CO_2 + 2\ H_2O$_____

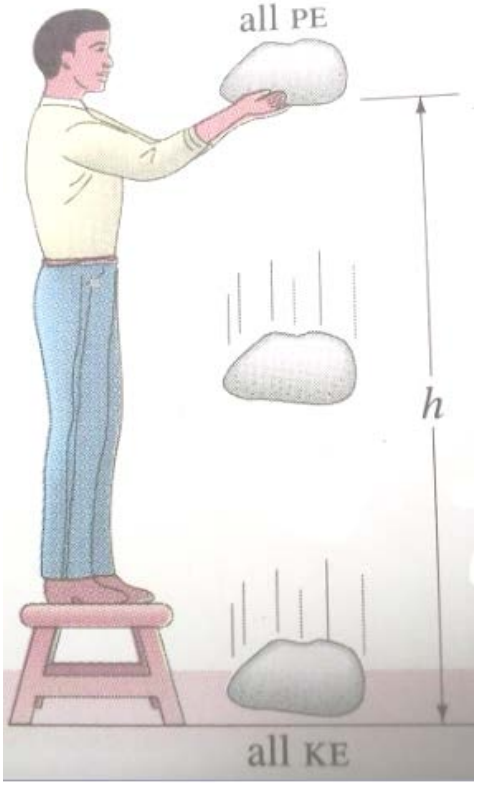
b) Freezing of water_____

c) Burning sugar_____

d) A + Q → AQ + heat_____

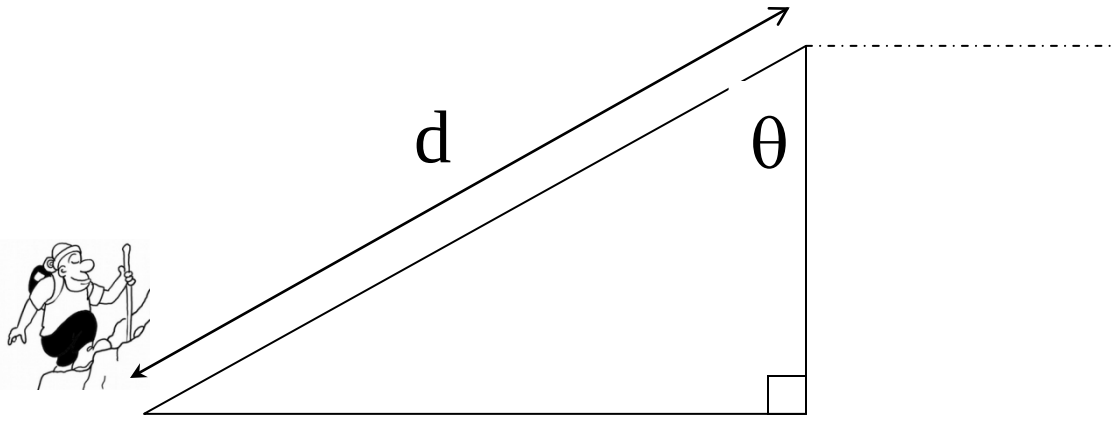
e) NH_4NO_3 dissolving, which makes the beaker cold_____

25. How fast is the rock travelling when it is 3.0 m(halfway) above the floor? No mass is needed to calculate this problem. Show why.



Total height = h = 6 m

26. a) If a 75 kg man walks up the hill, ignoring friction, what continuous force must he apply to climb the hill if the angle shown is 55^{o}? (3 marks)



b) Calculate the work done by the man if d = 60 m. (2 marks)