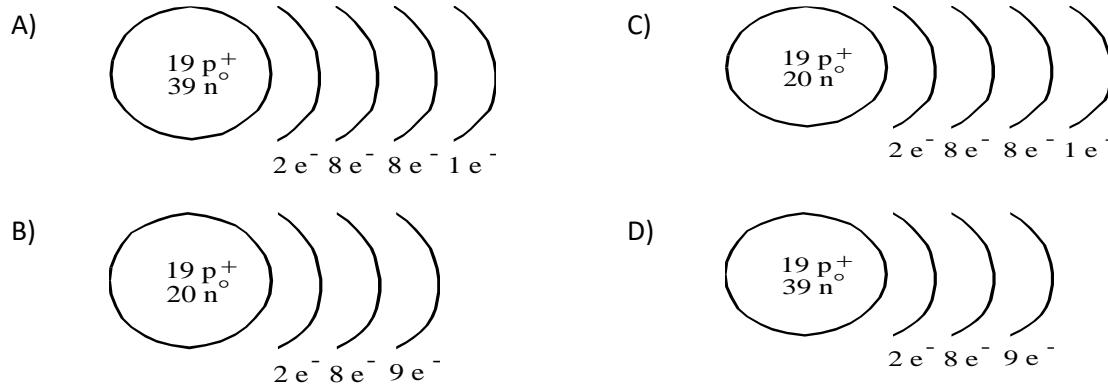


# January Exam Review

## A- Simplified atomic model

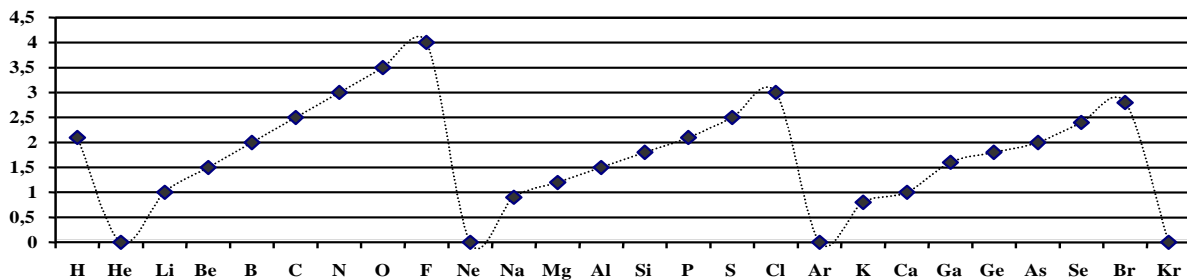
$P^+$  and  $n^+$  in the nucleus.  $e^-$  on orbits with a 2-8-8-2 possibility.

1. Which of the following best represents the simplified atomic model of a potassium atom,  ${}^{39}_{19}K$ ?



## B- Periodic trends

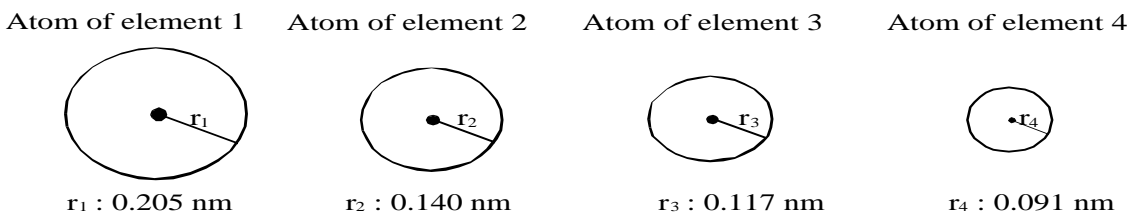
1. The graph below shows the electronegativity index of some elements of the periodic table.



Which of the following statement is true?

- A) The electronegativity index steadily increases within the same family.
- B) The electronegativity index steadily increases, then drops to 0 within the same period.
- C) The electronegativity index remains constant within the same family period as one goes from left to right on the periodic table.
- D) The electronegativity index steadily decreases within the same period.

2. The atomic size of an element is an example of a periodic property. The atomic size of the four elements below can be illustrated by using the atomic radius of each of these elements.



In which of the following periodic tables are these elements correctly placed?

A)

H			
	1		
	2		
	3		
	4		


C)

H			
1	2		

3	4

B)

4			
	3		

2	
	1

D)

H			
4	3		

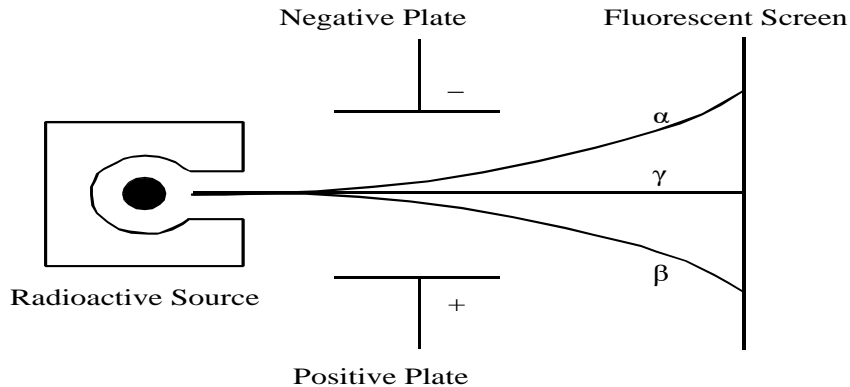
2	1

### C- Isotopes

- In general, in the periodic table, the atomic masses of elements increase as their atomic numbers increase. There are, however, exceptions to this rule. Which of the following accounts for these exceptions?
  - The number of electrons increases irregularly.
  - The number of particles in the nucleus increases regularly.
  - The number of neutrons increases irregularly.
  - The number of protons increases regularly.
- Silicon comes as three different isotopes: Si 27, Si 28 and Si 29
  - For each form of silicon give the atomic number
  - For each form of silicon give the neutron number
  - Which form of Silicon is most abundant

## D- Radioactivity

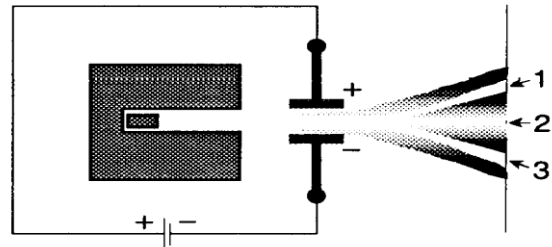
1. The results of an experiment dealing with radioactivity are illustrated below.



What can you conclude from this experiment?

- A) The atom consists of a nucleus and electrons.
- B) The alpha and beta radiation is electrically charged.
- C) The alpha and beta particles and the gamma rays have different masses.
- D) The alpha, beta and gamma radiation is able to penetrate matter.

2. The illustration at the right shows radiation from a radioactive point source passing through an electric field.



Which of the following correctly describes the rays formed after the radiation has passed through the electric field?

- A) Ray 1 : negatively charged gamma ( $\gamma$ ) rays  
Ray 2 : neutral alpha ( $\alpha$ ) particles  
Ray 3 : positively charged beta ( $\beta$ ) particles
- B) Ray 1 : negatively charged beta ( $\beta$ ) particles  
Ray 2 : neutral gamma ( $\gamma$ ) rays  
Ray 3 : positively charged alpha ( $\alpha$ ) particles
- C) Ray 1 : positively charged beta ( $\beta$ ) particles  
Ray 2 : neutral gamma ( $\gamma$ ) ray  
Ray 3 : negatively charged alpha ( $\alpha$ ) particles
- D) Ray 1 : negatively charged alpha ( $\alpha$ ) particles  
Ray 2 : neutral beta ( $\beta$ ) particles  
Ray 3 : positively charged gamma ( $\gamma$ ) rays

## E- Half life

- 15 g of uranium takes 35 000 years. Fill in the table to determine the percentage and amount left after 5 half lives have passed.
- If you are using radioactive substances in your body for medical reasons. Would you want to use an isotope with a long or short half life? Why
- If you are using radioactive substances to date an old bone. Would you want to use an isotope with a short or long half life? Why

## F- Bonds

- Give the molecular formula, Lewis diagram and name the bond between:
  - Aluminum and fluorine
  - Lithium and phosphorus
  - Phosphorus and chlorine
  - Calcium and bromine
  - Hydrogen and oxygen
  - Chlorine
- A compound is composed of hypothetical elements X and Y. X belongs to Family I A(1) and Y belongs to Family V A(15). What is the molecular formula of this compound?
- Among the following chemical formulas, which contains two radicals (complex ions)?  
A)  $\text{H}_2\text{SO}_4$                       B)  $\text{NH}_4\text{OH}$                       C)  $\text{NaNO}_3$                       D)  $\text{CaCO}_3$
- Which group of substances consists only of substances formed by covalent bonds?  
A)  $\text{K}_2\text{O}$ ,  $\text{PCl}_3$ ,  $\text{H}_2\text{S}$                       C)  $\text{CH}_4$ ,  $\text{CaS}$ ,  $\text{NCl}_3$   
B)  $\text{NaCl}$ ,  $\text{MgO}$ ,  $\text{AlF}_3$                       D)  $\text{NH}_3$ ,  $\text{O}_2$ ,  $\text{P}_2\text{O}_3$
- Which of the following molecular formulas represent ionic bonds?

1. $\text{LiCl}$	4. $\text{H}_2\text{O}$	7. $\text{K}_2\text{S}$
2. $\text{O}_2$	5. $\text{AlCl}_3$	8. $\text{N}_2\text{O}_3$
3. $\text{CH}_4$	6. $\text{CaF}_2$	

  
A) 1, 5, 6 and 7                      B) 1, 6, 7 and 8                      C) 2, 3, 4 and 5                      D) 2, 3, 4 and 8
- Which of the following compounds have covalent bonds?

1. $\text{Na}_2\text{CO}_3$	5. $\text{Ca}_3\text{N}_2$
2. $\text{C}_3\text{H}_8$	6. $\text{P}_2\text{O}_5$
3. $\text{Al}_4\text{C}_3$	7. $\text{PBr}_5$
4. $\text{Si}_3\text{N}_4$	8. $\text{Mg}_3\text{P}_2$

  
A) 1, 3, 5 and 8                      B) 1, 3, 6 and 8                      C) 2, 4, 5 and 7                      D) 2, 4, 6 and 7

7. Of the following statements correctly describe ionic bonds?
1. In reacting with water, potassium transfers an electron to produce potassium hydroxide, KOH.
  2. In reacting with a metal, sulphur normally accepts two electrons.
  3. Metals often form ionic bonds with one another.
  4. Chlorine atoms share two electrons to form chlorine gas, Cl<sub>2</sub>.
  5. H<sub>2</sub>O is an example of an ionic compound.
  6. Copper oxide, CuO, is an example of an ionic compound.
- A) 1, 2 and 4                      B) 1, 2 and 6                      C) 3, 4 and 5                      D) 3, 5 and 6
8. Among the following chemical formulas, identify those substances formed as a result of covalent bonding.
- |        |                     |                      |                      |
|--------|---------------------|----------------------|----------------------|
| 1. CsF | 2. PBr <sub>3</sub> | 3. CaI <sub>2</sub>  | 4. BaAt <sub>2</sub> |
| 5. SrO | 6. S <sub>8</sub>   | 7. AlCl <sub>3</sub> | 8. CO <sub>2</sub>   |
- A) 2, 6 and 8                      B) 1, 5 and 7                      C) 2, 4 and 8                      D) 3, 5 and 7
9. What is the correct molecular formula of a compound formed by an element "Y" from group IV A (4) and an element "Z" from group VI A (16)? Give the correct molecular formula for this compound.
10. A compound is made of two hypothetical elements, X and Z. Element X belongs to family II A(2) and element Z belongs to family V A(15). Which of the formulas below correctly represents this compound?
- A) X<sub>2</sub>Z<sub>3</sub>                      B) X<sub>3</sub>Z<sub>2</sub>                      C) X<sub>2</sub>Z<sub>5</sub>                      D) X<sub>5</sub>Z<sub>2</sub>
11. A compound contains the elements X and Y. Element X belongs to Group I A (1). Element Y belongs to Group VI A (16). What is the molecular formula of this compound?
- A) XY<sub>2</sub>                      B) XY<sub>6</sub>                      C) X<sub>2</sub>Y                      D) X<sub>6</sub>Y
12. Which of the following molecules is not consistent with the octet rule?
- A) CF<sub>4</sub>                      B) KO<sub>2</sub>                      C) MgCl<sub>2</sub>                      D) BaO
13. These elements combine to form compounds : Na, Ca, S, N, Al and Br. Which of the chemical formulas below respect the octet rule?
- A) NaBr, Ca<sub>2</sub>S, Na<sub>2</sub>S                      B) N<sub>2</sub>S<sub>3</sub>, SBr, AlS                      C) NaBr, Al<sub>2</sub>S<sub>3</sub>, NBr<sub>3</sub>                      D) AlS, Na<sub>2</sub>N, CaS
14. Based on their position in the Periodic Table, which two of the following elements can form three chemical bonds?
- |             |               |             |
|-------------|---------------|-------------|
| 1. Sodium   | 2. Calcium    | 3. Aluminum |
| 4. Chlorine | 5. Phosphorus | 6. Helium   |
- A) 1 and 5                      B) 2 and 4                      C) 3 and 6                      D) 3 and 5

## H- Phosphorus Cycle

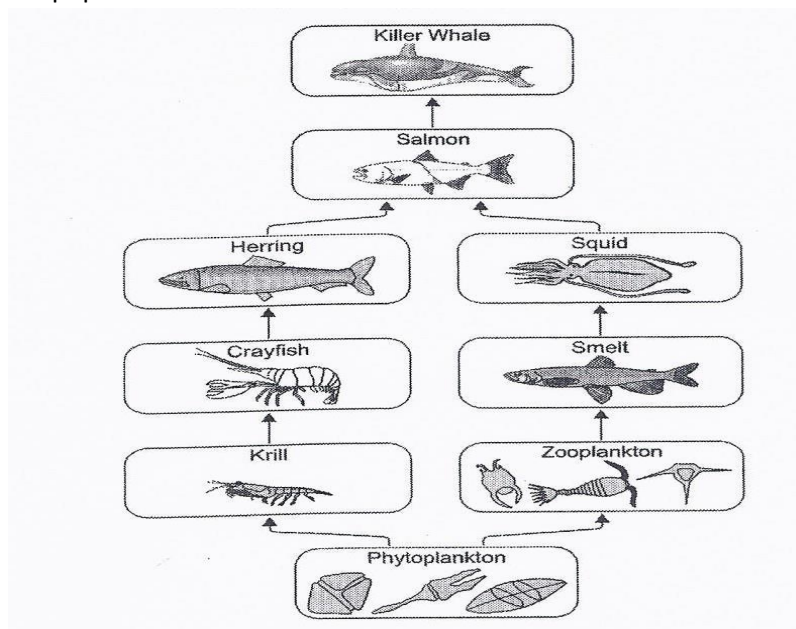
1. The accelerated eutrophication of lakes is a concern in several regions of Québec. One town in Québec passed by-laws requiring lakefront property owners to:
  - a) Plant more shrubs and trees along the shoreline.
  - b) Stop using chemical fertilizers on their lawns and gardens.

Explain how the requirements of the by-law listed above could help prevent accelerated eutrophication.

2. Give the steps in proper order of the phosphorus cycle.

## I- Ecosystems

1. Explain what an ecological footprint is.
2. Explain what ecotoxicology is and toxicity threshold is.
3. A population of killer whales in the Gulf of St. Lawrence is listed as endangered under the Canadian Species at Risk Act. This species spends about half the year foraging in inland waters and relies almost exclusively on salmon as prey. Recent data suggests that this killer whale population has declined approximately 7% over the past 4 years. The concentration of water contaminants (mercury, pesticides, PCBs) has been steadily increasing in the last 4 years and traces of these amounts were found in all species of plants and animals living in the Gulf of St. Lawrence. Using the information provided, choose the answer which best gives a possible explanation for the decline of this killer whale population.



4. Explain how biotechnology can be used for pollutants in soil and water.

## J- Genetics

1. Cells are able to produce the proteins they need to properly function. Listed below are 4 steps involved in protein synthesis.

Steps	Protein synthesis process
1	Translation of mRNA into a protein
2	Genetic information of DNA copied to mRNA
3	End of protein synthesis
4	Attachment of mRNA to ribosome

Which of the steps above take(s) place in the cytoplasm of the cell?

- A) 2 only                      B) 1 and 2                      C) 1, 3 and 4                      D) 2, 3 and 4
2. Answer questions A-H using the lead DNA strand below

GAGTAATAATGAACCGAA

- A- Complimentary strand:  
 B- mRNA strand:  
 C- tRNA strand:  
 D- AA produced:  
 E- Is it possible to change the codon CUC and still keep the same AA?  
 F- What would happen if a 'T' is added before the first nucleotide?

3. Answer the questions using the following DNA sequence.

C A A A G G A T A T A C C A A T C C A G A A T G A T C

Give the sequence of amino acids produced.

4. The lab technician at your high school asked you to make cue cards of the protein synthesis process. However, you dropped them on the way to school.

Cue Cards Protein Synthesis

1- Translation occurs at the ribosome. The ribosome moves along the mRNA strand reading each nucleotide triplet.
2- The newly formed mRNA travels from the nucleus into the cytoplasm and attaches to a ribosome.
3- The resulting polypeptide chain, once complete, folds into a specific shape in the cytoplasm.
4- Unzipped DNA serves as a blueprint for mRNA.
5- Transcription occurs. This is the process through which a DNA sequence is copied to produce a complementary mRNA.

6- The tRNA carries amino acids to the site of each nucleotide triplet. These amino acids link together.

You must place the cards in the correct order. Indicate the correct step number next to cue card description.

- A) 1 – 2 – 4 – 3 – 5 – 6                      C) 5 – 1 – 6 – 4 – 2 – 3  
 B) 4 – 5 – 2 – 1 – 6 – 3                      D) 5 – 2 – 3 – 4 – 1 – 6

5. In genetics, every term has a very precise meaning.

Match the statements with the corresponding vocabulary words.

Statements		Vocabulary	
I.	Remy is PPGg.	1.	Dominance
II.	Catherine has curly blond hair.	2.	Genotype
III.	Gabriel has blue eyes while his parents have brown eyes.	3.	Phenotype
		4.	Recessivity

- A) I-2, II-1, III-3                      B) I-2, II-3, III-4    C) I-3, II-4, III-2    D) I-4, II-3, III-1

6. Huntington's is a fatal autosomal dominant disease. If a heterozygous man who has Huntington's marries a normal female, what are the chances that their child will have Huntington's?

What are the chances that the offspring will be colour blind if a male who is not colour blind has children with a carrier?

7. What are the chances that the offspring will be colour blind if a male who is not colour blind has children with a carrier?

8. Tongue rolling is a dominant trait as is having free earlobes as opposed to attached earlobes.

- A) Use a dihybrid cross to show all the possible offspring produced when a female who is heterozygous for tongue rolling and homozygous dominant for her ears is crossed with a male who cannot roll his tongue and is heterozygous for ear attachment.  
 B) Give the phenotype ratio of all the possible offspring.  
 C) Give the genotype ratio for all the possible offspring.