Unit 1 MC Homework

1. A student has a $1\ \text{g}$ sample of each of the following compounds: NaCl, KBr, and KCl. Which of the following lists the samples in order of increasing number of moles in the sample?

(A) $\text{NaCl} < \text{KCl} < \text{KBr}$

(B) $\text{NaCl} < \text{KBr} < \text{KCl}$

(C) $\text{KCl} < \text{NaCl} < \text{KBr}$

(D) $\text{KBr} < \text{KCl} < \text{NaCl}$

2. A student obtains a sample of a pure solid compound. In addition to Avogadro's number, which of the following must the student know in order to determine how many molecules are in the sample?

(A) Mass of the sample, volume of the sample

(B) Mass of the sample, density of the sample

(C) Molar mass of the compound, mass of the sample

(D) Molar mass of the compound, density of the sample

3. Which of the following numerical expressions gives the number of particles in $2.0\ \text{g}$ of Ne?

(A) $\frac{6.0 \times 10^{23}\ \text{particles/mol}}{2.0\ \text{g}}$

(B) $\frac{6.0 \times 10^{23}\ \text{particles/mol}}{20.18\ \text{g/mol}}$

(C) $\frac{2.0\ \text{g}}{20.18\ \text{g/mol}}(6.0 \times 10^{23}\ \text{particles/mol})$

(D) $\frac{20.18\ \text{g/mol}}{2.0\ \text{g}}(6.0 \times 10^{23}\ \text{particles/mol})$

4. The mass spectrum of the element Sb is most likely represented by which of the following?

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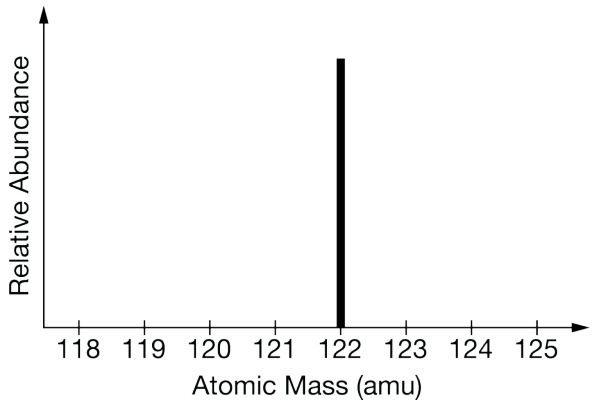
(A)



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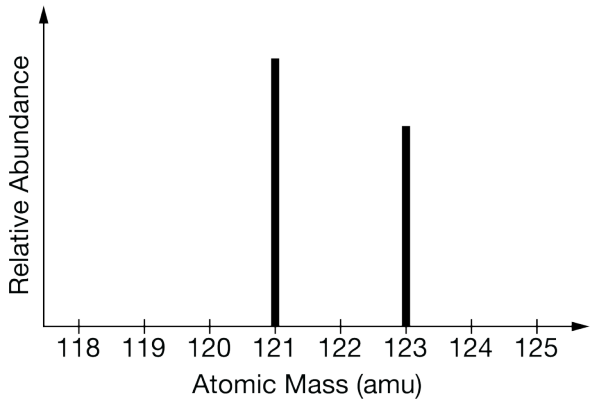

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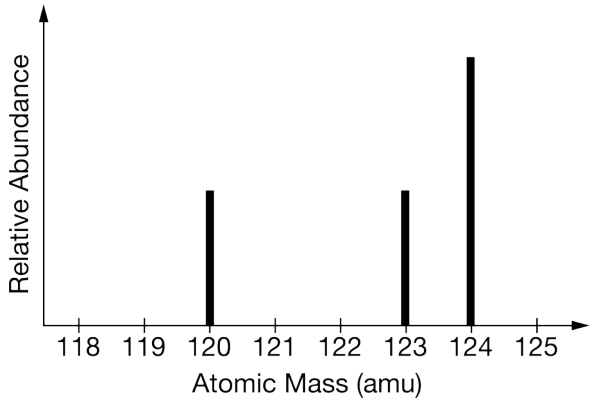

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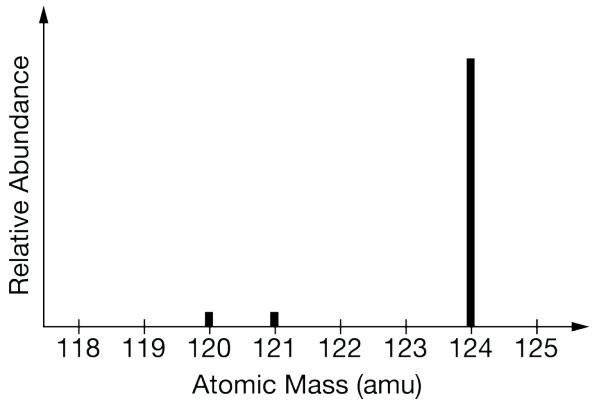

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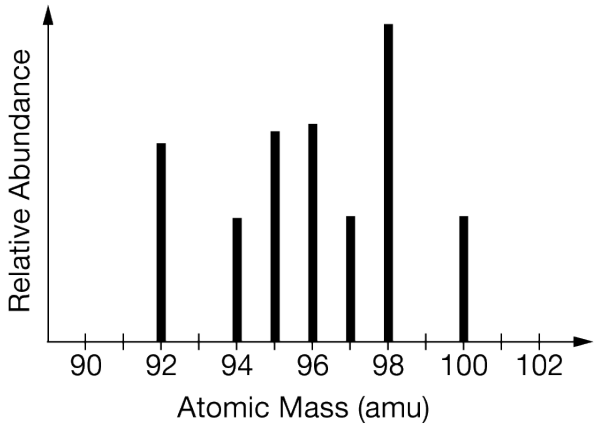
5.



Which of the following elements has the mass spectrum represented above?

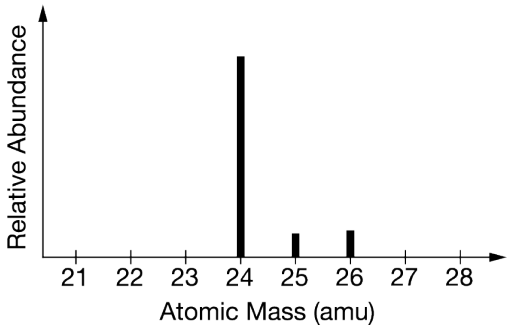
(A) Nb

(B) Mo

(C) U

(D) Cf

6.



The mass spectrum of a sample of a pure element is shown above. Based on the data, the peak at 26 amu represents an isotope of which of the following elements?

(A) Al with 13 neutrons

(B) Mg with 14 neutrons

(C) Fe with 26 neutrons

(D) Ti with 26 neutrons

7. Two different ionic compounds each contain only copper and chlorine. Both compounds are powders, one white and one brown. An elemental analysis is performed on each powder. Which of the following questions about the compounds is most likely to be answered by the results of the analysis?

(A) What is the density of each pure compound?

(B) What is the formula unit of each compound?

(C) What is the chemical reactivity of each compound?

(D) Which of the two compounds is more soluble in water?

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8. A student has two samples of NaCl, each one from a different source. Assume that the only potential contaminant in each sample is KCl. The student runs an experiment to determine the percent by mass of chlorine in each sample. From the results of this experiment alone, which of the following questions is most likely to be answered?

(A) Which sample has the higher purity?

(B) Which sample has the higher density?

(C) What is the source of the contaminants present in each of the samples?

(D) Which sample came from a salt mine, and which sample came from the ocean?

9. A student has samples of two pure compounds, $\mathrm{XClO_3}$ and $\mathrm{ZClO_3}$, which contain unknown alkali metals X and Z. The student measures the mass of each sample and then strongly heats the samples to drive off all the oxygen, leaving solid residues of XCl and ZCl. The student measures the mass of the solid residue from each sample. Which of the following questions can be answered from the results of the experiment?

(A) Which has the greater molar mass, X or Z?

(B) Which has the higher boiling point, X or Z?

(C) Which has the higher melting point, XCl or ZCl?

(D) Which has the greater density, XCl or ZCl?

10. A student is given two $10\mathrm{g}$ samples, each a mixture of only $\mathrm{NaCl}(s)$ and $\mathrm{KCl}(s)$ but in different proportions. Which of the following pieces of information could be used to determine which mixture has the higher proportion of $\mathrm{KCl}(s)$?

(A) The volume of each mixture

(B) The mass of Cl in each mixture

(C) The number of isotopes of Na and K

(D) The reaction of each mixture with water

11.

1	2	3	4	5	6	7
Total mass of sample (g)	Mass of C in sample (g)	Mass of Mg in sample (g)	Mass of Ca in sample (g)	Molar mass of $\mathrm{C}\ (\mathrm{g/mol})$	Molar mass of $\mathrm{Mg}\ (\mathrm{g/mol})$	Molar mass of $\mathrm{Ca}\ (\mathrm{g/mol})$
98.5	12.0	2.4	36.1	12.0	24.3	40.1

A sample of carbonate rock is a mixture of $\mathrm{CaCO_3}$ and $\mathrm{MgCO_3}$. The rock is analyzed in a laboratory, and the results are recorded in the table above. Which columns in the table provide all the information necessary to determine the mole ratio of Ca to Mg in the rock?

(A) 1, 2, 5

(B) 2, 5, 6

(C) 3, 4, 6, 7

(D) 2, 3, 4, 5

12. A $5.0\ \mathrm{g}$ sample of $\mathrm{MgCl_2}$ may contain measurable amounts of other compounds as impurities. Which of the following quantities is (are) needed to determine that the sample is pure $\mathrm{MgCl_2}$?

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(A) The color and density of the sample

(B) The mass of Mg in the sample only

(C) The number of moles of Cl in the sample only

(D) The mass of Mg and the mass of Cl in the sample

13. Which of the following ground-state electron configurations represents the atom that has the lowest first-ionization energy?

(A) $1s^2\ 2s^1$

(B) $1s^2\ 2s^2 2p^2$

(C) $1s^2\ 2s^2 2p^6$

(D) $1s^2\ 2s^2 2p^6\ 3s^1$

14. Which of the following best represents the ground-state electron configuration for an atom of selenium?

(A) $1s^2\ 2s^2 2p^6\ 3s^2 3p^3$

(B) $1s^2\ 2s^2 2p^6\ 3s^2 3p^4$

(C) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^4$

(D) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

15. Which of the following is the ground-state electron configuration of the F^- ion?

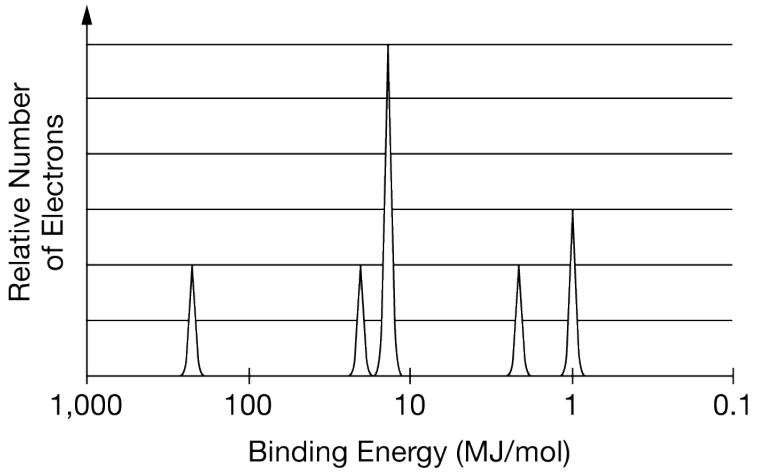
(A) $1s^2\ 2s^2 2p^4$

(B) $1s^2\ 2s^2 2p^5$

(C) $1s^2\ 2s^2 2p^6$

(D) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6$

16.



The complete photoelectron spectrum of an element is given above. Which of the following electron configurations is consistent with the spectrum?

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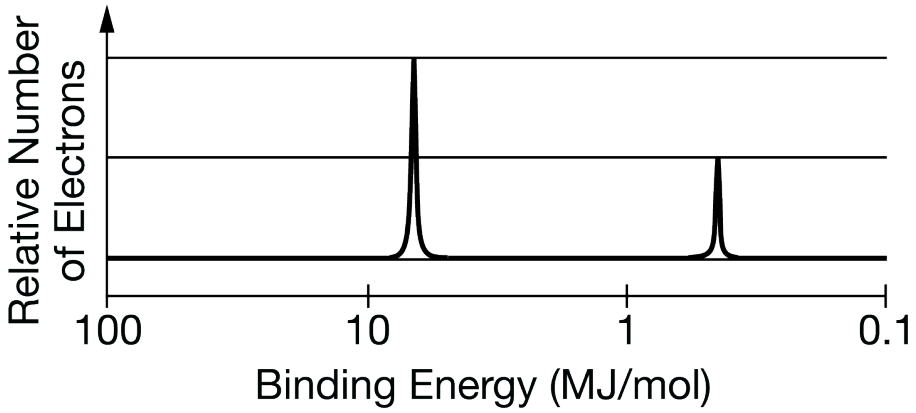
(A) $1s^2\ 2s^2 2p^1$

(B) $1s^2\ 2s^2 2p^6\ 3s^2 3p^3$

(C) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6$

(D) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6 4s^2\ 3d^5$

17.



The complete photoelectron spectrum for an element is shown above. Which of the following observations would provide evidence that the spectrum is consistent with the atomic model of the element?

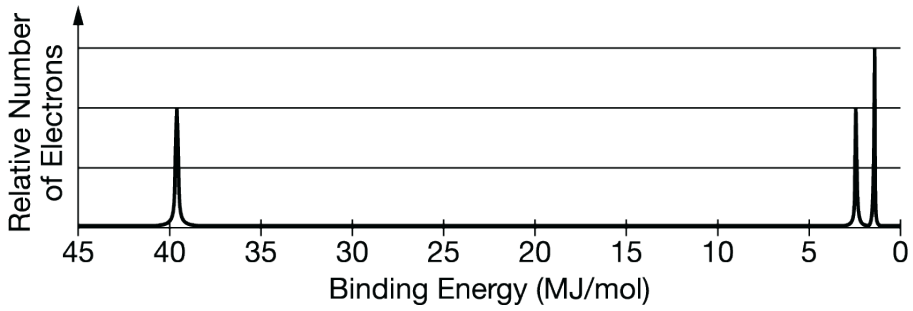
(A) A neutral atom of the element contains exactly two electrons.

(B) The element does not react with other elements to form compounds.

(C) In its compounds, the element tends to form ions with a charge of $+1$.

(D) In its compounds, the element tends to form ions with a charge of $+3$.

18.



The photoelectron spectrum for the element nitrogen is represented above. Which of the following best explains how the spectrum is consistent with the electron shell model of the atom?

(A) The leftmost peak represents the valence electrons.

(B) The two peaks at the right represent a total of three electrons.

(C) The electrons in the $1s$ sublevel have the smallest binding energy.

(D) The electrons in the $2p$ sublevel have the smallest binding energy.

19. Which of the following represents an electron configuration that corresponds to the valence electrons of an element for which there is an especially large jump between the second and third ionization energies? (Note: n represents a principal quantum number equal to or greater than 2.)

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(A) ns^2

(B) ns^2np^1

(C) ns^2np^2

(D) ns^2np^3

20. Which of the following best helps explain why the electronegativity of Cl is less than that of F?

(A) The mass of the Cl atom is greater than the mass of the F atom.

(B) The Cl nucleus contains more protons than the F nucleus contains.

(C) When Cl and F form bonds with other atoms, the Cl bonding electrons are more shielded from the positive Cl nucleus than the F bonding electrons are shielded from the positive F nucleus.

(D) Because Cl is larger than F, the repulsions among electrons in the valence shell of Cl are less than the repulsions among electrons in the valence shell of F.

21. Which of the following best helps to explain why the electron affinity of Br has a greater magnitude than that of I?

(A) Br has a lower electronegativity than I does.

(B) Br has a lower ionization energy than I does.

(C) An added electron would go into a new shell in Br but not in I.

(D) There is a greater attraction between an added electron and the nucleus in Br than in I.

22. If Na reacts with chlorine to form NaCl, which of the following elements reacts with Na to form an ionic compound in a one-to-one ratio, and why?

(A) K, because it is in the same group as Na.

(B) Mg, because its mass is similar to that of Na.

(C) Ar, because its mass is similar to that of Cl.

(D) Br, because it has the same number of valence electrons as Cl.

23.

Metal	Be	Mg	Ca	Sr	Ba	Ra
Formula of Metal Chloride	$\mathrm{BeCl_2}$	$\mathrm{MgCl_2}$	$\mathrm{CaCl_2}$	$\mathrm{SrCl_2}$	$\mathrm{BaCl_2}$	$\mathrm{RaCl_2}$

All the chlorides of the alkaline earth metals have similar empirical formulas, as shown in the table above. Which of the following best helps to explain this observation?

(A) $\mathrm{Cl_2}(g)$ reacts with metal atoms to form strong, covalent double bonds.

(B) Cl has a much greater electronegativity than any of the alkaline earth metals.

(C) The two valence electrons of alkaline earth metal atoms are relatively easy to remove.

(D) The radii of atoms of alkaline earth metals increase moving down the group from Be to Ra.

24. RbCl has a high boiling point. Which of the following compounds is also likely to have a high boiling point, and why?

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(A) NO, because its elements are in the same period of the periodic table.

(B) ClF, because its elements are in the same group of the periodic table.

(C) Cl_2O, because its elements have similar electronegativities and it is a covalent compound.

(D) $CsCl$, because its elements have very different electronegativities and it is an ionic compound.