Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) In which set of elements would all members be expected to have very similar chemical properties? 1) _____
A) O, S, Se
B) Na, Mg, K
C) Ne, Na, Mg
D) N, O, F
E) S, Se, Si

2) Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar? 2) _____
A) Na > Mg > Si > P > Ar
B) Mg > Na > P > Si > Ar
C) Ar > P > Si > Mg > Na
D) Ar > Si > P > Na > Mg
E) Si > P > Ar > Na > Mg

3) Screening of the nuclear charge by core electrons in atoms is _____. 3) _____
A) responsible for a general decrease in atomic radius going down a group
B) more efficient than that by valence electrons
C) less efficient than that by valence electrons
D) essentially identical to that by valence electrons
E) both essentially identical to that by valence electrons and responsible for a general decrease in atomic radius going down a group

4) Which one of the following has the smallest radius? 4) _____
A) Na B) Br C) P D) Cl E) Fe

5) Which isoelectronic series is correctly arranged in order of increasing radius? 5) _____
A) $Cl^- < Ar < K^+ < Ca^{2+}$
B) $Ca^{2+} < K^+ < Cl^- < Ar$
C) $Ca^{2+} < K^+ < Ar < Cl^-$
D) $Ca^{2+} < Ar < K^+ < Cl^-$
E) $K^+ < Ca^{2+} < Ar < Cl^-$

6) Which equation correctly represents the first ionization of aluminum? 6) _____
A) $Al\,(g) \rightarrow Al^+\,(g) + e^-$
B) $Al^-\,(g) \rightarrow Al\,(g) + e^-$
C) $Al^+\,(g) + e^- \rightarrow Al\,(g)$
D) $Al\,(g) \rightarrow Al^-\,(g) + e^-$
E) $Al\,(g) + e^- \rightarrow Al^-\,(g)$

7) Which of the following has the largest second ionization energy? 7) _____
A) K B) Ge C) Ca D) Se E) Ga

8) The acidity of carbonated water is due to the _____. 8) _____

A) presence of sulfur
B) addition of acid
C) nonmetal oxides
D) reaction of CO_2 and H_2O
E) none of the above

9) Of the following oxides, _____ is the most acidic. 9) _____

A) CO_2 B) Al_2O_3 C) Li_2O D) CaO E) Na_2O

10) When two elements combine to form a compound, the greater the difference in metallic character between the two elements, the greater the likelihood that the compound will be _____. 10) _____

A) a solid at room temperature
B) a gas at room temperature
C) metallic
D) a liquid at room temperature
E) nonmetallic

11) This element is more reactive than lithium and magnesium but less reactive than potassium. This element is _____. 11) _____

A) Ca B) Fr C) Rb D) Na E) Be

12) Consider the following properties of an element: 12) _____

(i) It is solid at room temperature.
(ii) It easily forms an oxide when exposed to air.
(iii) When it reacts with water, hydrogen gas evolves.
(iv) It must be stored submerged in oil.

Which element fits the above description the best?

A) sodium
B) magnesium
C) sulfur
D) mercury
E) copper

13) Which one of the following compounds produces a basic solution when dissolved in water? 13) _____

A) CO_2 B) OF_2 C) O_2 D) Na_2O E) SO_2

14) This element reacts with hydrogen to produce a gas with the formula HX. When dissolved in water, HX forms an acidic solution. X is _____, 14) _____

A) Na B) H C) Br D) O E) C

15) Hydrogen is unique among the elements because _____. 15) _____

1. It is not really a member of any particular group.
2. Its electron is not at all shielded from its nucleus.
3. It is the lightest element.
4. It is the only element to exist at room temperature as a diatomic gas.
5. It exhibits some chemical properties similar to those of groups 1A and 7A.

A) 1, 2, 3, 4, 5 B) 1, 4, 5 C) 3, 4 D) 2, 3, 4, 5 E) 1, 2, 3, 5

16) A group of ions all containing the same number of electrons constitute an isoelectronic series. 16) _____
A) True B) False

17) Elements that readily conduct electricity are elements with low ionization energies. 17) _____
A) True B) False

18) Which ion below has a noble gas electron configuration? 18) _____
A) Li^{2+} B) N^{2-} C) C^{2+} D) Be^{2+} E) B^{2+}

19) Which of the following has eight valence electrons? 19) _____
A) Kr
B) Na^{+}
C) Ti^{4+}
D) Cl^{-}
E) all of the above

20) The chloride of which of the following metals should have the greatest lattice energy? 20) _____
A) lithium B) potassium C) cesium D) rubidium E) sodium

21) Lattice energy is _____. 21) _____
A) the energy required to produce one mole of an ionic compound from its constituent elements in their standard states
B) the energy required to convert a mole of ionic solid into its constituent ions in the gas phase
C) the sum of electron affinities of the components in an ionic solid
D) the energy given off when gaseous ions combine to form one mole of an ionic solid
E) the sum of ionization energies of the components in an ionic solid

22) Fe^{+2} ions are represented by _____. 22) _____
A) $[Ar]3d^{10}4s^{1}$
B) $[Ar]3d^{1}$
C) $[Ar]3d^{3}$
D) $[Ar]3d^{4}$
E) $[Ar]3d^{6}$

23) In which of the molecules below is the carbon-carbon distance the shortest? 23) _____
A) $H_3C\text{-}CH_3$
B) $H_3C\text{-}CH_2\text{-}CH_3$
C) $H\text{-}C{\equiv}C\text{-}H$
D) $H_2C{=}CH_2$
E) $H_2C{=}C{=}CH_2$

24) Of the atoms below, _____ is the most electronegative. 24) _____
A) O B) N C) F D) Br E) Cl

25) There are _____ valence electrons in the Lewis structure of CH_3CH_2Cl. 25) _____
A) 12 B) 14 C) 18 D) 20 E) 10

26) Of the following, _____ cannot accommodate more than an octet of electrons. 26) _____

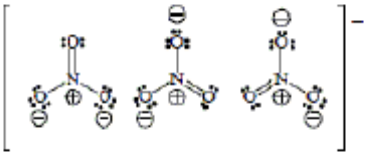
A) P B) O C) As D) I E) S

27) The greater the lattice energy, the greater the charges on the participatory ions and the smaller their radii. 27) _____

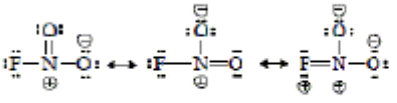
A) True B) False

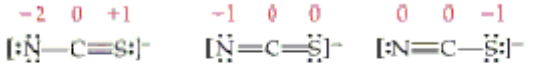
ESSAY. Write your answer in the space provided or on a separate sheet of paper.

NO_2^- $N + 3O + (-) = 5 + (3)(0) + 1 = 24$

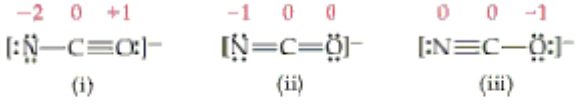


FNO_2 $F + N + 2O = 7 + 5 + (2)(6) = 24$





The middle Lewis structure is the dominant one for NCS^- as it places the negative charge on the more electronegative atom

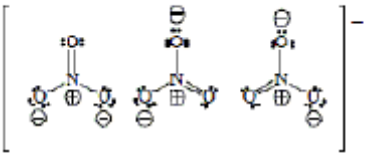


(i) (ii) (iii)

Structure (iii), which places a negative charge on oxygen, the most electronegative element in the ion, is the dominant Lewis structure

28)

NO_3^- $N + 3O + (-) = 5 + (3)(6) + 1 = 24$



FNO_2 $F + N + 2O = 7 + 5 + (2)(6) = 24$