KEY

General&Analytical Chemistry I
CHMG.141.02

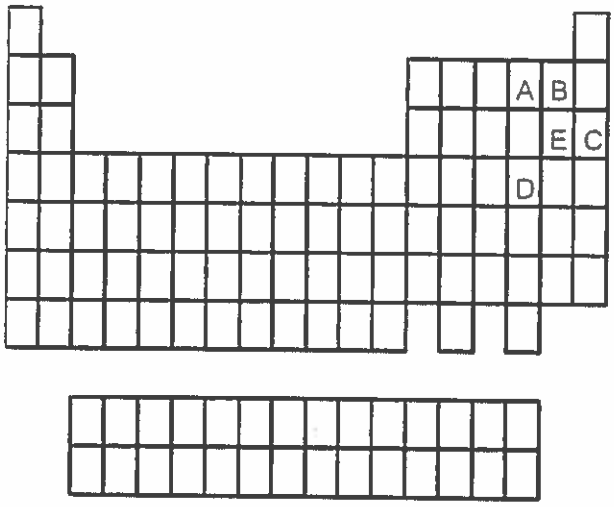
Exam 4 (Final)
V.1

Name_____

R = 0.0821 L. atm/mol . K
A = 6.022×10^{23}

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

1) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?



A) A (B) B C) C D) D

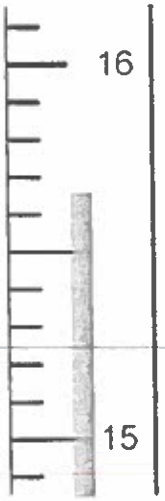
2) Which ion has the same electron configuration as Kr?

A) Br^-
B) Se^{2-}
C) Rb^+
D) All of the above

3) Of the following, which atom has the smallest atomic radius?

A) S
B) Mg
C) Sr
D) Te

4) What is the temperature reading on the following Celsius thermometer?



A) 16°C
B) 15.67°C
C) 15°C
D) 15.6°C

5) The greater the energy of a photon, the

A) shorter the wavelength and the higher the frequency.
B) shorter the wavelength and the lower the frequency.
C) longer the wavelength and the higher the frequency.
D) longer the wavelength and the lower the frequency.

$E_{ph} = h \cdot \nu = h \frac{c}{\lambda}$

6) How many protons (p), neutrons (n), and electrons (e) are in one atom of $^{23}_{12}Mg$?

$\#n = 23 - 12 = 11 n$

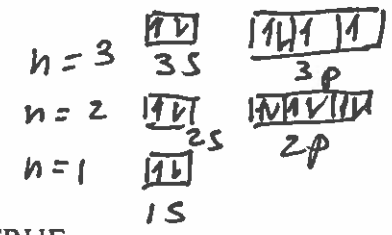
A) 12 p, 12 n, 12 e
B) 12 p, 11 n, 12 e
C) 12 p, 11 n, 10 e
D) 12 p, 11 n, 14 e

7) Give the ground state electron configuration for Se.

A) $[Ar]4s^23d^{10}4p^6$
B) $[Ar]4s^23d^{10}$
C) $[Ar]3d^{10}4p^4$
D) $[Ar]4s^23d^{10}4p^4$
E) $[Ar]4s^24d^{10}4p^4$

8) How many unpaired electrons are present in the ground state S atom?

A) 0
B) 2
C) 3
D) 4
E) 1



9) Choose the statement that is TRUE.

A) Core electrons efficiently shield outer electrons from nuclear charge.
B) Outer electrons efficiently shield one another from nuclear charge.
C) Core electrons are the easiest of all electrons to remove.
D) Valence electrons are most difficult of all electrons to remove.
E) All of the above are true.

10) You can identify a metal by carefully determining its density. A 20.05 g cylinder of an unknown metal is 2.00 cm long and has a diameter of 0.755 cm. What is a possible identity of the element? (Volume = $\pi r^2 h$; $\pi = 3.14$)

a) silver, 10.5 g/cm^3
b) iridium, 22.4 g/cm^3
c) Gold, 19.3 g/cm^3
d) Lead, 11.4 g/cm^3
e) Nickel, 8.90 g/cm^3

$r = \frac{d}{2}$

$V = 3.14 \times \left(\frac{1}{2} \times 0.755\,cm\right)^2 \times 2.00\,cm =$
$= 0.895\,cm^3$

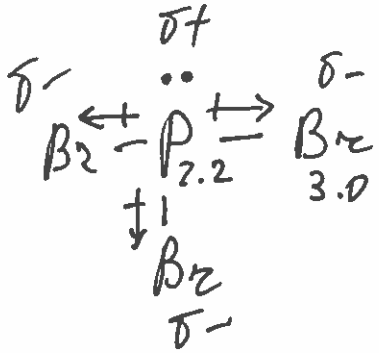
$D = \frac{mass}{V} = \frac{20.05\,g}{0.895\,cm^3} = 22.4\,\frac{g}{cm^3}$

11) Which of the following ionic compounds would be expected to have the highest lattice energy?

A) LiCl
B) NaCl
C) KCl
D) RbCl

12) The phosphorus atom in PBr_3 would be expected to have a

A) partial positive (δ+) charge.
B) partial negative (δ-) charge.
C) 3+ charge.
D) 3- charge

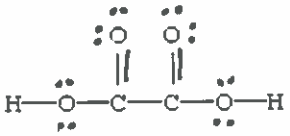


$\Delta = 3 - 2.2 = 0.8$

13) The reaction $2\ HNO_3(aq) + Ba(OH)_2(aq) \rightarrow Ba(NO_3)_2(aq) + 2\ H_2O(l)$ is best classified as a(n) acid base salt water

A) acid-base neutralization reaction.
B) oxidation-reduction reaction.
C) precipitation reaction.
D) single replacement reaction.

14) Consider a molecule with the following connections (skeletal structure):

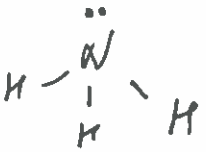


Finish the Lewis dot structure.
When a valid electron dot structure is written, how many double bonds will the molecule contain?

A) 0
B) 1
C) 2
D) 4

15) What is the molecular geometry of NH_3?

A) linear
B) bent
C) trigonal pyramidal
D) tetrahedral



16) Balance the following reaction. When the reaction is balanced, there are 8 atoms of oxygen and 14 atoms of hydrogen on each side.

$$(NH_4)_2SO_4\ (aq) + Ba(C_2H_3O_2)_2\ (aq) \rightarrow BaSO_4\ (s) + 2\ NH_4C_2H_3O_2\ (aq)$$

A) 6; 11
B) 16; 28
C) 4; 7
D) 8; 14
E) 16; 18

17) What is the mass of 8.50×10^{22} molecules of NH_3?

A) 0.00830 g
B) 0.417 g
C) 2.40 g
D) 120 g

$$8.50 \times 10^{22}\ \text{molec} \times \frac{1\ \text{mol}_{NH_3}}{6.022 \times 10^{23}\ \text{molec}} \times \frac{17.03\ \text{g}}{1\ \text{mol}_{NH_3}} = 2.40\ \text{g}$$

18) How many grams of calcium chloride are needed to produce 10.0 g of potassium chloride?

$$CaCl_2(aq) + K_2CO_3(aq) \rightarrow 2\ KCl(aq) + CaCO_3(aq)$$

? g → 10.0 g

A) 0.134 g
B) 7.44 g
C) 14.9 g
D) 29.8 g

$$10.0\ \text{g}_{KCl} \times \frac{1\ \text{mol}_{KCl}}{74.55\ \text{g}} \times \frac{1\ \text{mol}_{CaCl_2}}{2\ \text{mol}_{KCl}} \times \frac{110.98\ \text{g}}{1\ \text{mol}_{CaCl_2}} = 7.44\ \text{g}$$

19) A balanced **net ionic** equation for the reaction of $Pb(NO_3)_2(aq)$ with $NaI(aq)$.

A) $Pb(NO_3)_2(aq) + 2\ NaI(aq) \rightarrow PbI_2(s) + 2\ NaNO_3(aq)$
B) $Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ Na^+(aq) + 2\ I^-(aq) \rightarrow Pb^{2+}(aq) + 2\ I^-(aq) + 2\ Na^+(aq) + 2\ NO_3^-(aq)$
C) $Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ Na^+(aq) + 2\ I^-(aq) \rightarrow PbI_2(s) + 2\ Na^+(aq) + 2\ NO_3^-(aq)$
D) $Pb^{2+}(aq) + 2\ I^-(aq) \rightarrow PbI_2(s)$

20) What element is undergoing reduction (if any) in the following reaction?

$$Zn(s) + 2\ AgNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + 2\ Ag(s)$$

A) Zn
B) Ag
C) O
D) N
A) This is not an oxidation-reduction reaction

$$Ag^+ + 1\bar{e} \rightarrow Ag$$
$$+1 \qquad\qquad 0$$

GER

21) What is the chemical formula for strontium hydroxide?

A) SrH_2
B) $SrOH_2$
C) SrOH
D) $Sr(OH)_2$

22) How much energy is evolved during the reaction of 48.7 g of Al, according to the reaction below? Assume that there is excess Fe_2O_3.

$$Fe_2O_3(s) + 2\,Al(s) \rightarrow Al_2O_3(s) + 2\,Fe(s) \qquad \Delta H°_{rxn} = -852\ kJ$$

48.7 g

A) 769 kJ
B) 241 kJ
C) 130 kJ
D) 207 kJ
E) 415 kJ

$$48.7\,g_{Al} \times \frac{1\,mol_{Al}}{26.96\,g} \times \frac{852\ kJ}{2\,mol_{Al}} = \boxed{769\ kJ}$$

23) Acetylene torches utilize the following reaction:

$$2\,C_2H_2(g) + 5\,O_2(g) \rightarrow 4\,CO_2(g) + 2\,H_2O(g)$$

Use the given standard enthalpies of formation to calculate $\Delta H°$ for this reaction

Species	$\Delta H°_f$, kJ/mol
$C_2H_2(g)$	+227.4
$CO_2(g)$	-393.5
$H_2O(g)$	-241.8

$$\Delta H°_{RXN} = \sum \Delta H°_f\ (prod) - \sum \Delta H°_f\ (react) =$$

$$= [4\cdot(-393.5) + 2(-241.8)] - [2(+227.4)] = \boxed{-2512.4\ kJ}$$

A) 2512.4 kJ
B) 1256.2 kJ
C) -1256.2 kJ
D) -2512.4 kJ

24) Place the following gases in order of increasing density at STP.

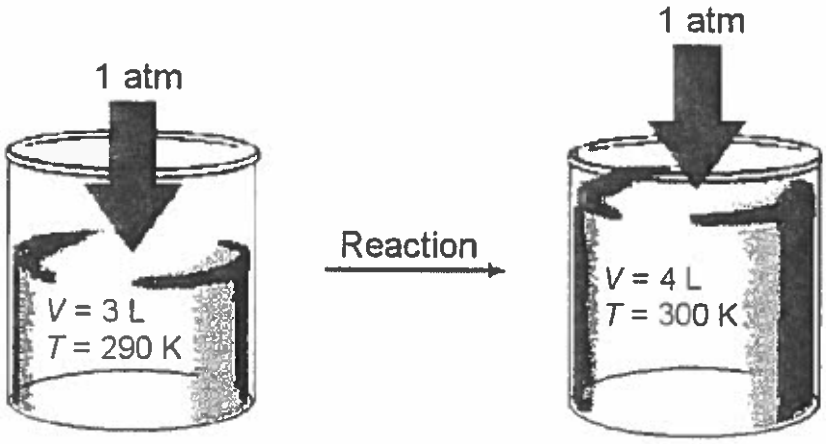
	N_2	NH_3	N_2O_4	Ar
MM	28.02	17.04	92.0	39.95

A) Ar < N_2O_4 < N_2 < NH_3
B) NH_3 < N_2 < Ar < N_2O_4
C) N_2O_4 < Ar < N_2 < NH_3
D) N_2 < Ar < N_2O_4 < NH_3
E) Ar < N_2 < NH_3 < N_2O_4

25) How many electrons can a single orbital hold?

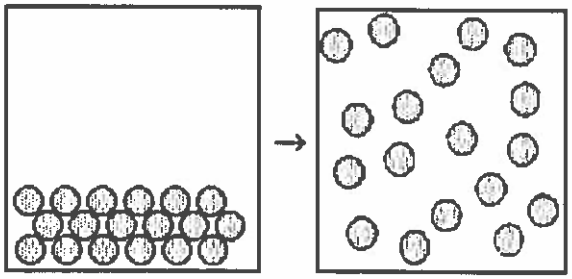
A) $2n$
B) 2
C) $2l + 1$
D) 8

26) Imagine a reaction that results in a change in both volume and temperature, as shown in the diagram below.
What is the sign of the work being done by the reaction and the sign of the enthalpy change of the reaction? (Tip: temperature corresponds to the surroundings)



A) w = + and ΔH = +
B) w = + and ΔH = -
C) w = - and ΔH = +
D) w = - and ΔH = -

27) What are the signs of ΔH, ΔS, and ΔG for the following spontaneous change (for example liquid state to gas state)?



A) ΔH = +, ΔS = +, ΔG = -
B) ΔH = +, ΔS = -, ΔG = -
C) ΔH = -, ΔS = +, ΔG = -
D) ΔH = -, ΔS = -, ΔG = -

28) How many milliliters of a 9.0 M H_2SO_4 solution are needed to make 0.25 L of a 3.5 M H_2SO_4 solution? Tip: Dilution problem

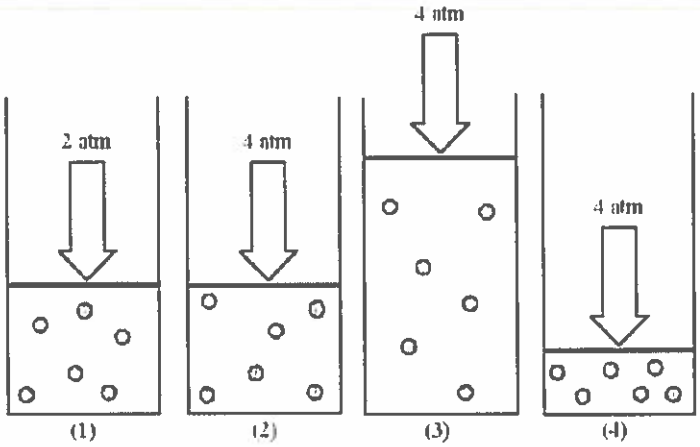
A) 0.64 mL
B) 640 mL
C) 97 mL
D) 0.097 mL

$M_1 \times V_1 = M_2 \times V_2$

$V_1 = \frac{M_2 \times V_2}{M_1} = \frac{3.5 \frac{mol}{L} \times 0.25 L}{9.0 \frac{mol}{L}} = 0.097 L =$

$= \boxed{97 mL}$

29) Assume that you have a sample of gas in a cylinder with a moveable piston, as shown in diagram (1). The initial pressure, number of moles, and temperature of the gas are noted on the diagram.



Which diagram (2)-(4) most closely represents the result of doubling (increasing by factor 2) the pressure while keeping the temperature and number of moles of gas constant?

A) diagram (2)
B) diagram (3)
C) diagram (4)

$P_1 V_1 = P_2 V_2$

Boyle's Law

30) Of the species below, only _____ is **not** an electrolyte.

acid → A) $HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$

B) NaCl
C) Ar ← No ions. Doesn't conduct electricity.
D) KOH
E) Rb_2SO_4

Ionic compounds

31) What is the empirical formula for ethyl fluoride if the compound contains 49.97% carbon, 10.51% hydrogen, and 39.52% fluorine by mass?

A) C_2H_5F
B) $C_2H_5F_2$
C) $C_4H_{10}F_4$
D) $C_4H_{10}F_2$

100 g – total

C $49.97\,g \times \frac{1\,mol}{12.01} = 4.16\,mol$

H $10.51\,g \times \frac{1\,mol}{1.01\,g} = 10.41\,mol$

F $39.52\,g \times 1\,mol/19.00\,g = 2.08\,mol$

$C_{\frac{4.16}{2.08}} H_{\frac{10.41}{2.08}} F_{\frac{2.08}{2.08}}$

C_2H_5F

32) What volume will 4.91×10^{22} atoms of Ne occupy at STP?

A) 1.10 L
B) 2.00 L
C) 1.83 L
D) 2.24 L
E) 3.11 L

$4.91 \times 10^{22}\,at \times \frac{1\,mol}{6.022 \times 10^{23}\,at} \times \frac{22.4\,L}{1\,mol} = 1.83\,L$

33) Determine the specific heat capacity of an alloy that requires 59.3 kJ to raise the temperature of 150.0 g alloy from 298 K to 398 K.

A) 3.95 J/g°C
B) 4.38 J/g°C
C) 1.87 J/g°C
D) 2.29 J/g°C
E) 2.53 J/g°C

$q = m \cdot c \cdot \Delta T$

$c = \frac{q}{m \cdot \Delta T} = \frac{59.3\,kJ \times \frac{10^3\,J}{1\,kJ}}{150.0\,g \cdot (398 - 298)} =$

$= \frac{3.95\,\frac{J}{g \cdot °C}}{(02\,K)}$

34) How many electrons are in the ion, Zn^{2+}?

A) 28
B) 30
C) 32
D) 65

35) Determine the theoretical yield of K_2CO_3 produced from reacting 27.9 g KO_2 with 29.0 L of CO_2 (at STP). The molar mass of KO_2 = 71.10 g/mol and K_2CO_3 = 138.21 g/mol. **Tip: This is a Limiting reagent problem**

$$4\,KO_2(s) + 2\,CO_2(g) \rightarrow 2\,K_2CO_3(s) + 3\,O_2(g)$$

A) 206 g
B) 61.0 g
C) 91.7 g
D) 179 g
E) 27.1 g

See the next page

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$PV = n \cdot R \cdot T$

$n = \frac{P \cdot V}{R \cdot T}$ = at STP $29.0\,L \times \frac{1\ mol}{22.4\,L} =$

$= 1.29\ mol\ CO_2$

~~27.~~

$1.29\ mol\ CO_2 \times \frac{2\ mol\ K_2CO_3}{2\ mol\ CO_2} =$

$= \boxed{1.29\ mol\ K_2CO_3}$

$27.9\ g\ KO_2 \times \frac{1\ mol\ KO_2}{71.1\ g\ KO_2} \times \frac{2\ mol\ K_2CO_3}{4\ mol\ KO_2} = 0.196\ mol\ K_2CO_3$

KO_2 - limiting reagent

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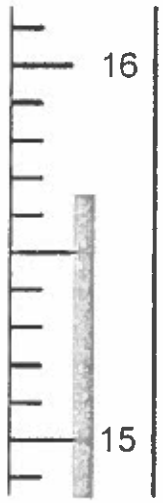

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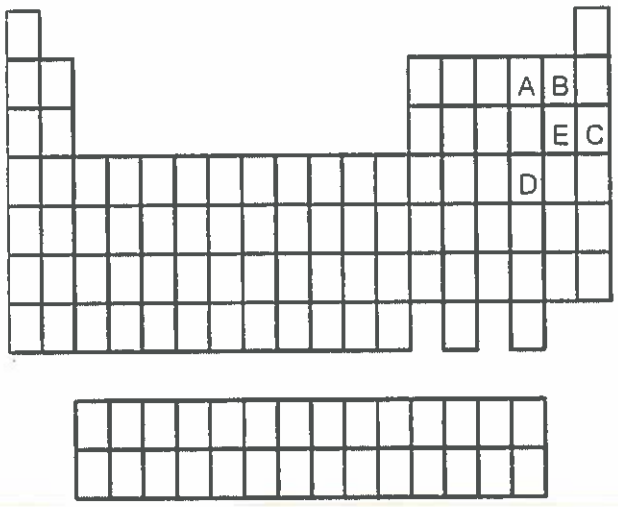

A) A B) B C) C D) D

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E) $[Ar]4s^23d^{10}4p^6$

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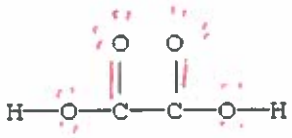

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B) $Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ Na^+(aq) + 2\ I^-(aq) \rightarrow Pb^{2+}(aq) + 2\ I^-(aq) + 2\ Na^+(aq) + 2\ NO_3^-(aq)$
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D) $Pb^{2+}(aq) + 2\ I^-(aq) \rightarrow PbI_2(s)$

20) What element is undergoing reduction (if any) in the following reaction?

$$Zn(s) + 2\ AgNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + 2\ Ag(s)$$

A) Zn
B) Ag
C) O
D) N
E) This is not an oxidation-reduction reaction

21) What is the chemical formula for strontium hydroxide?

A) SrH_2
B) $SrOH_2$
C) SrOH
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22) How much energy is evolved during the reaction of 48.7 g of Al, according to the reaction below? Assume that there is excess Fe_2O_3.

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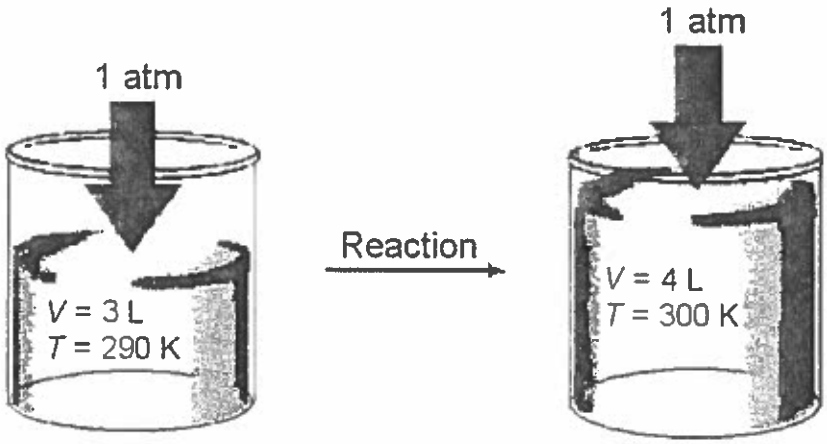
N_2 NH_3 N_2O_4 Ar

A) $Ar < N_2O_4 < N_2 < NH_3$
B) $NH_3 < N_2 < Ar < N_2O_4$
C) $N_2O_4 < Ar < N_2 < NH_3$
D) $N_2 < Ar < N_2O_4 < NH_3$
E) $Ar < N_2 < NH_3 < N_2O_4$

25) How many electrons can a single orbital hold?
A) $2n$
B) 2
C) $2l + 1$
D) 8

26) Imagine a reaction that results in a change in both volume and temperature, as shown in the diagram below.
What is the sign of the work being done by the reaction and the sign of the enthalpy change of the reaction? (Tip: temperature corresponds to the surroundings)



A) w = + and ΔH = +
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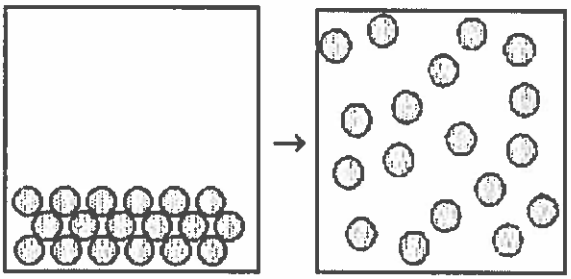
27) What are the signs of ΔH, ΔS, and ΔG for the following spontaneous change (for example liquid state to gas state)?



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B) ΔH = +, ΔS = -, ΔG = -
C) ΔH = -, ΔS = +, ΔG = -
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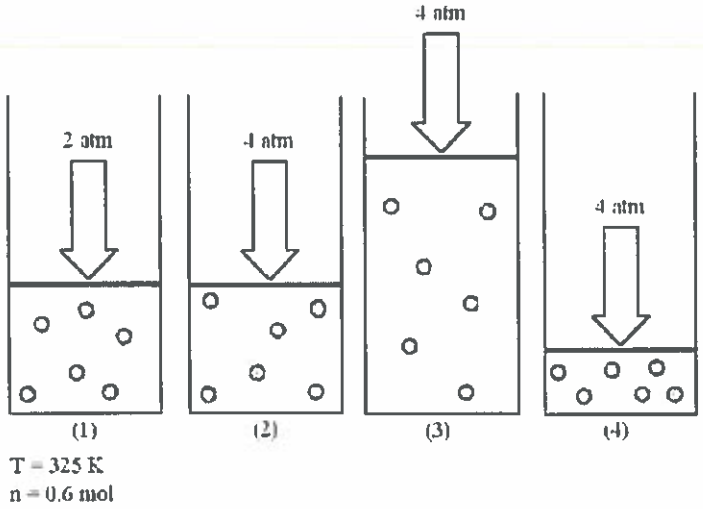
28) How many milliliters of a 9.0 M H_2SO_4 solution are needed to make 0.25 L of a 3.5 M H_2SO_4 solution? Tip: Dilution problem

A) 0.64 mL
B) 640 mL
C) 97 mL
D) 0.097 mL

29) Assume that you have a sample of gas in a cylinder with a moveable piston, as shown in diagram (1). The initial pressure, number of moles, and temperature of the gas are noted on the diagram.



Which diagram (2)-(4) most closely represents the result of doubling (increasing by factor 2) the pressure while keeping the temperature and number of moles of gas constant?
A) diagram (2)
B) diagram (3)
C) diagram (4)

30) Of the species below, only H_2 (C) is **not** an electrolyte.

A) HCl
B) NaCl
C) Ar
D) KOH
E) Rb_2SO_4

31) What is the empirical formula for ethyl fluoride if the compound contains 49.97% carbon, 10.51% hydrogen, and 39.52% fluorine by mass?

A) C_2H_5F
B) $C_2H_5F_2$
C) $C_4H_{10}F_4$
D) $C_4H_{10}F_2$

32) What volume will 4.91×10^{22} atoms of Ne occupy at STP?

A) 1.10 L
B) 2.00 L
C) 1.83 L
D) 2.24 L
E) 3.11 L

33) Determine the specific heat capacity of an alloy that requires 59.3 kJ to raise the temperature of 150.0 g alloy from 298 K to 398 K.

A) 3.95 J/g°C
B) 4.38 J/g°C
C) 1.87 J/g°C
D) 2.29 J/g°C
E) 2.53 J/g°C

34) How many electrons are in the ion, Zn^{2+}?

A) 28
B) 30
C) 32
D) 65

35) Determine the theoretical yield of K_2CO_3 produced from reacting 27.9 g KO_2 with 29.0 L of CO_2 (at STP). The molar mass of KO_2 = 71.10 g/mol and K_2CO_3 = 138.21 g/mol. **Tip: This is a Limiting reagent problem**

$$4\ KO_2(s) + 2\ CO_2(g) \rightarrow 2\ K_2CO_3(s) + 3\ O_2(g)$$

A) 206 g
B) 61.0 g
C) 91.7 g
D) 179 g
E) 27.1 g

KEY

General&Analytical Chemistry I
CHMG.141.02

Exam 4 (Final)

V.3

Name_____

R = 0.0821 L. atm/mol . K
A = 6.022×10^{23}

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

1) How many protons (p), neutrons (n), and electrons (e) are in one atom of $^{23}_{12}Mg$?

A) 12 p, 12 n, 12 e
B) 12 p, 11 n, 12 e
C) 12 p, 11 n, 10 e
D) 12 p, 11 n, 14 e

2) Give the ground state electron configuration for Se.

A) $[Ar]4s^23d^{10}$
B) $[Ar]3d^{10}4p^4$
C) $[Ar]4s^23d^{10}4p^4$
D) $[Ar]4s^24d^{10}4p^4$
E) $[Ar]4s^23d^{10}4p^6$

3) How many unpaired electrons are present in the ground state S atom?

A) 0
B) 2
C) 3
D) 4
E) 1

4) Choose the statement that is TRUE.

A) Core electrons efficiently shield outer electrons from nuclear charge.
B) Outer electrons efficiently shield one another from nuclear charge.
C) Core electrons are the easiest of all electrons to remove.
D) Valence electrons are most difficult of all electrons to remove.
E) All of the above are true.

5) You can identify a metal by carefully determining its density. A 20.05 g cylinder of an unknown metal is 2.00 cm long and has a diameter of 0.755 cm. What is a possible identity of the element? (Volume = $\pi r^2 h$; $\pi = 3.14$)

A) Silver, 10.5 g/cm^3
B) Iridium, 22.4 g/cm^3
C) Lead, 11.4 g/cm^3
D) Nickel, 8.90 g/cm^3
E) Gold, 19.3 g/cm^3

6) Which of the following ionic compounds would be expected to have the highest lattice energy?
A) LiCl
B) NaCl
C) KCl
D) RbCl

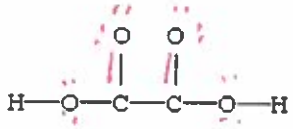
7) The phosphorus atom in PBr_3 would be expected to have a
A) partial positive (δ+) charge.
B) partial negative (δ-) charge.
C) 3+ charge.
D) 3- charge

8) The reaction $2\ HNO_3(aq) + Ba(OH)_2(aq) \rightarrow Ba(NO_3)_2(aq) + 2\ H_2O(l)$ is best classified as a(n)
A) acid-base neutralization reaction.
B) oxidation-reduction reaction.
C) precipitation reaction.
D) single replacement reaction.

9) What is the molecular geometry of NH_3?

A) linear
B) bent
C) trigonal pyramidal
D) tetrahedral

10) Consider a molecule with the following connections (skeletal structure):



Finish the Lewis dot structure.
When a valid electron dot structure is written, how many double bonds will the molecule contain?

A) 0
B) 1
C) 2
D) 4

11) Balance the following reaction. When the reaction is balanced, there are 8 atoms of oxygen and 14 atoms of hydrogen on each side.

$$(NH_4)_2SO_4\ (aq) + Ba(C_2H_3O_2)_2\ (aq) \rightarrow BaSO_4\ (s) + 2\,NH_4C_2H_3O_2\ (aq)$$

A) 6; 11
B) 16; 28
C) 4; 7
D) 8; 14
E) 16; 18

12) What is the mass of 8.50×10^{22} molecules of NH_3?

A) 0.00830 g
B) 0.417 g
C) 2.40 g
D) 120 g

13) How many grams of calcium chloride are needed to produce 10.0 g of potassium chloride?

$$CaCl_2(aq) + K_2CO_3(aq) \rightarrow 2\ KCl(aq) + CaCO_3(aq)$$

A) 0.134 g
B) 7.44 g
C) 14.9 g
D) 29.8 g

14) A balanced **net ionic** equation for the reaction of $Pb(NO_3)_2(aq)$ with $NaI(aq)$.

A) $Pb(NO_3)_2(aq) + 2\ NaI(aq) \rightarrow PbI_2(s) + 2\ NaNO_3(aq)$
B) $Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ Na^+(aq) + 2\ I^-(aq) \rightarrow Pb^{2+}(aq) + 2\ I^-(aq) + 2\ Na^+(aq) + 2\ NO_3^-(aq)$
C) $Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ Na^+(aq) + 2\ I^-(aq) \rightarrow PbI_2(s) + 2\ Na^+(aq) + 2\ NO_3^-(aq)$
D) $Pb^{2+}(aq) + 2\ I^-(aq) \rightarrow PbI_2(s)$

15) What element is undergoing reduction (if any) in the following reaction?

$$Zn(s) + 2\ AgNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + 2\ Ag(s)$$

A) Zn
B) Ag
C) O
D) N
E) This is not an oxidation-reduction reaction

16) What is the chemical formula for strontium hydroxide?

A) SrH_2
B) $SrOH_2$
C) SrOH
D) $Sr(OH)_2$

17) How much energy is evolved during the reaction of 48.7 g of Al, according to the reaction below? Assume that there is excess Fe_2O_3.

$$Fe_2O_3(s) + 2\ Al(s) \rightarrow Al_2O_3(s) + 2\ Fe(s) \qquad \Delta H°_{rxn} = -852\ kJ$$

A) 769 kJ
B) 241 kJ
C) 130 kJ
D) 207 kJ
E) 415 kJ

18) How many electrons can a single orbital hold?
A) $2n$
B) 2
C) $2l + 1$
D) 8

19) Acetylene torches utilize the following reaction:

$$2\ C_2H_2(g) + 5\ O_2(g) \rightarrow 4\ CO_2(g) + 2\ H_2O(g)$$

Use the given standard enthalpies of formation to calculate $\Delta H°$ for this reaction

Species	$\Delta H°_f$, kJ/mol
$C_2H_2(g)$	+227.4
$CO_2(g)$	-393.5
$H_2O(g)$	-241.8

A) 2512.4 kJ
B) 1256.2 kJ
C) -1256.2 kJ
D) -2512.4 kJ

20) Place the following gases in order of increasing density at STP.

N_2 NH_3 N_2O_4 Ar

A) Ar < N_2O_4 < N_2 < NH_3
B) NH_3 < N_2 < Ar < N_2O_4
C) N_2O_4 < Ar < N_2 < NH_3
D) N_2 < Ar < N_2O_4 < NH_3
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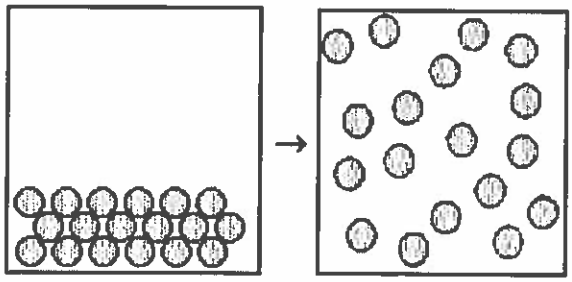
21) What are the signs of ΔH, ΔS, and ΔG for the following spontaneous change (for example liquid state to gas state)?



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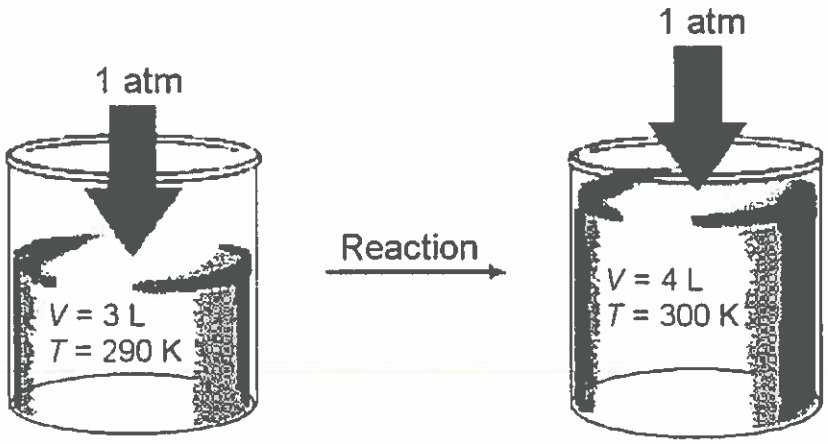

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A) 0.64 mL
B) 640 mL
C) 97 mL
D) 0.097 mL

24) Of the species below, only A2 is **not** an electrolyte.

A) HCl
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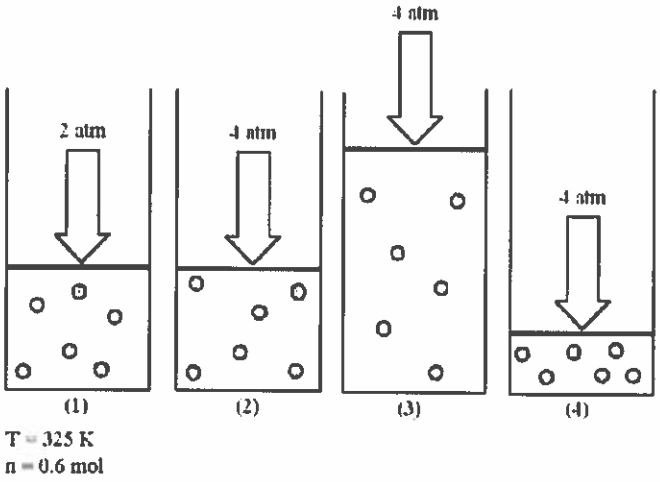

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27) What volume will 4.91×10^{22} atoms of Ne occupy at STP?

A) 1.10 L
B) 2.00 L
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28) The greater the energy of a photon, the

A) shorter the wavelength and the lower the frequency.
B) longer the wavelength and the higher the frequency.
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29) Determine the specific heat capacity of an alloy that requires 59.3 kJ to raise the temperature of 150.0 g alloy from 298 K to 398 K.

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C) 32
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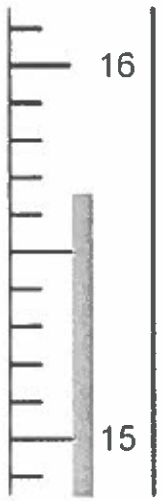
31) What is the temperature reading on the following Celsius thermometer?



A) 16°C
B) 15.67°C
C) 15°C
D) 15.6°C

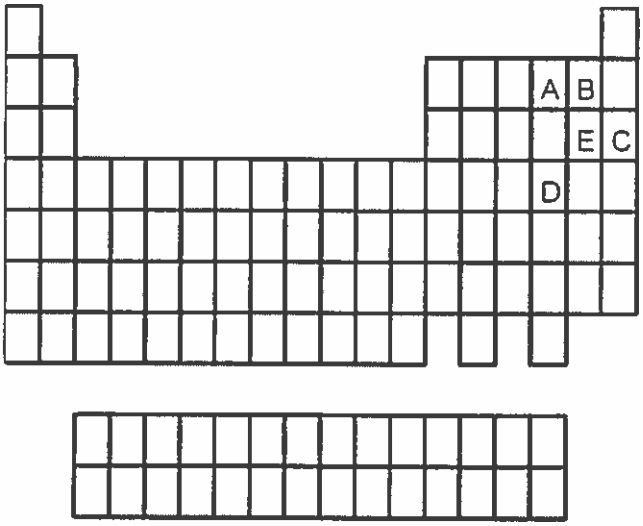
32) Which ion has the same electron configuration as Kr?

A) Br^-
B) Se^{2-}
C) Rb^+
D) All of the above

33) Of the following, which atom has the smallest atomic radius?

A) S
B) Mg
C) Sr
D) Te

34) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?



A) A B) B C) C D) D

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