Exam

Name_____

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

1) Under appropriate conditions, nitrogen and hydrogen undergo a combination reaction to yield ammonia: 1) _____

$$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$$

A 7.1–g sample of $N_2$ requires _____ g of $H_2$ for complete reaction.

A) 0.51 B) 1.5 C) 0.76 D) 17.2 E) 1.2

2) How many moles of magnesium oxide are produced by the reaction of 3.82 g of magnesium nitride with 7.73 g of water? 2) _____

$$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$$

A) 0.0756 B) 0.113 C) 4.57 D) 0.0378 E) 0.429

3) Of the species below, only _____ is NOT an electrolyte. 3) _____

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

4) With which of the following will ammonium ion form an insoluble salt? 4) _____

A) chloride
B) carbonate
C) sulfate and carbonate
D) sulfate
E) none of the above

5) A weak electrolyte exists predominantly as _____ in solution. 5) _____

A) electrons B) ions C) an isotope D) atoms E) molecules

6) Which of the following are weak electrolytes? 6) _____

1) HCl
2) $HC_2H_3O_2$
3) $NH_3$
4) KCl

A) $HC_2H_3O_2$ , KCl
B) HCl , $HC_2H_3O_2$ , KCl
C) HCl , $HC_2H_3O_2$ , $NH_3$ , KCl
D) HCl , KCl
E) $HC_2H_3O_2$ , $NH_3$

7) Which ion(s) is/are spectator ions in the formation of a precipitate of AgCl via combining aqueous solutions of $CoCl_2$ and $AgNO_3$? 7) _____

A) $Co^{2+}$ and $NO_3^-$

B) $NO_3^-$ and $Cl^-$

C) $Cl^-$

D) $NO_3^-$

E) $Co^{2+}$ and $Ag^+$

8) When $H_2SO_4$ is neutralized by NaOH in aqueous solution, the net ionic equation is _____. 8) _____

A) $SO_4^{2-}$ (aq) + $2Na^+$ (aq) → $Na_2SO_4$ (s)

B) $H_2SO_4$ (aq) + $2OH^-$ (aq) → $2H_2O$ (l) + $SO_4^{2-}$ (aq)

C) $2H^+$ (aq) + 2NaOH (aq) → $2H_2O$ (l) + $2Na^+$ (aq)

D) $SO_4^{2-}$ (aq) + $2Na^+$ (aq) → $Na_2SO_4$ (aq)

E) $H^+$ (aq) + $OH^-$ (aq) → $H_2O$ (l)

9) The molarity of a solution prepared by diluting 43.72 mL of 5.005 M aqueous $K_2Cr_2O_7$ to 500 mL is _____. 9) _____

A) 0.0044 B) 57.2 C) 0.870 D) 0.0879 E) 0.438

10) The balanced reaction between aqueous nitric acid and aqueous strontium hydroxide is _____. 10) _____

A) $HNO_3$ (aq) + $Sr(OH)_2$ (aq) → $H_2O$ (l) + $Sr(NO_3)_2$ (aq)

B) $HNO_3$ (aq) + $Sr(OH)_2$ (aq) → $Sr(NO_3)_2$ (aq) + $H_2$ (g)

C) $HNO_3$ (aq) + SrOH (aq) → $H_2O$ (l) + $SrNO_3$ (aq)

D) $2HNO_3$ (aq) + $Sr(OH)_2$ (aq) → $2H_2O$ (l) + $Sr(NO_3)_2$ (aq)

E) $2HNO_3$ (aq) + $Sr(OH)_2$ (aq) → $Sr(NO_3)_2$ (aq) + $2H_2$ (g)

11) The net ionic equation for the dissolution of zinc metal in aqueous hydrobromic acid is _____. 11) _____

A) $2Zn$ (s) + $H^+$ (aq) → $2Zn^{2+}$ (aq) + $H_2$ (g)

B) Zn (s) + $2Br^-$ (aq) → $ZnBr_2$ (aq)

C) Zn (s) + $2H^+$ (aq) → $Zn^{2+}$ (aq) + $H_2$ (g)

D) Zn (s) + 2HBr (aq) → $ZnBr_2$ (s) + $2H^+$ (aq)

E) Zn (s) + 2HBr (aq) → $ZnBr_2$ (aq) + $2H^+$ (aq)

12) Which of the following is an oxidation–reduction reaction? 12) _____

A) $AgNO_3$ (aq) + HCl (aq) → AgCl (s) + $HNO_3$ (aq)

B) HCl (aq) + NaOH (aq) → $H_2O$ (l) + NaCl (aq)

C) Cu (s) + $2AgNO_3$ (aq) → 2Ag (s) + $Cu(NO_3)_2$ (aq)

D) $H_2CO_3$ (aq) + $Ca(NO_3)_2$ (aq) → $2HNO_3$ (aq) + $CaCO_3$ (s)

E) $Ba(C_2H_3O_2)_2$ (aq) + $Na_2SO_4$ (aq) → $BaSO_4$ (s) + $2NaC_2H_3O_2$ (aq)

13) _____ is an oxidation reaction. 13) _____

A) The reaction of sodium chloride with lead nitrate to form lead chloride and sodium nitrate
B) Ice melting in a soft drink
C) Table salt dissolving in water for cooking vegetables
D) Rusting of iron
E) Neutralization of HCl by NaOH

14) Which combination will produce a precipitate? 14) _____

A) $AgNO_3$ (aq) and $Ca(C_2H_3O_2)_2$ (aq)
B) KOH (aq) and $Mg(NO_3)_2$ (aq)
C) NaOH (aq) and HCl (aq)
D) $NaC_2H_3O_2$ (aq) and HCl (aq)
E) NaOH (aq) and HCl (aq)

15) Which compound has the atom with the highest oxidation number? 15) _____

A) $NH_4Cl$ B) $Na_3N$ C) $MgSO_3$ D) $Al(NO_2)_3$ E) CaS

16) The reaction 16) _____

$$4Al\ (s) + 3O_2\ (g) \rightarrow 2Al_2O_3\ (s) \qquad \Delta H° = -3351\ kJ$$

is _____, and therefore heat is _____ by the reaction.

A) exothermic, released
B) exothermic, absorbed
C) endothermic, absorbed
D) endothermic, released
E) thermoneutral, neither released nor absorbed

17) The value of $\Delta E$ for a system that performs 213 kJ of work on its surroundings and loses 79 kJ of 17) _____
heat is _____ kJ.

A) –213 B) –292 C) –134 D) +292 E) +134

18) The value of $\Delta H°$ for the reaction below is +128.1 kJ: 18) _____

$$CH_3OH\ (l) \rightarrow CO\ (g) + 2H_2\ (g)$$

How many kJ of heat are consumed when 15.5 g of $CH_3OH$ (l) decomposes as shown in the equation?

A) 62.0 B) 8.3 C) $1.3 \times 10^2$ D) 32 E) 0.48

19) Which one of the following conditions would always result in an increase in the internal energy of 19) _____
a system?

A) The system loses heat and has work done on it by the surroundings.
B) The system loses heat and does work on the surroundings.
C) The system gains heat and does work on the surroundings.
D) The system gains heat and has work done on it by the surroundings.
E) None of the above is correct.

20) Of the following, which one is a state function? 20) _____

A) q
B) w
C) heat
D) H
E) none of the above

21) The units of of specific heat are _____. 21) _____

A) g–K/J or g–°C/J
B) K/J or °C/J
C) J/g–K or J/g–°C
D) J/mol
E) J/K or J/°C

22) For which one of the following reactions is the value of $\Delta H°_{rxn}$ equal to $\Delta H°_f$ for the product? 22) _____

A) 2 C (s, graphite) + 2 $H_2$ (g) → $C_2H_4$ (g)
B) 2 $H_2$ (g) + $O_2$ (g) → 2 $H_2O$ (g)
C) $N_2$ (g) + $O_2$ (g) → 2 NO (g)
D) $H_2O$ (l) + 1/2 $O_2$ (g) → $H_2O_2$ (l)
E) 2 $H_2$ (g) + $O_2$ (g) → 2 $H_2O$ (l)

23) The value of ΔH° for the reaction below is –72 kJ. _____ kJ of heat are released when 1.0 mol of HBr is formed in this reaction. 23) _____

$H_2$ (g) + $Br_2$ (g) → 2HBr (g)

A) 36 B) 0.44 C) 72 D) 144 E) –72

24) For which one of the following reactions is the value of $\Delta H°_{rxn}$ equal to $\Delta H_f°$ for the product? 24) _____

A) C (diamond) + $O_2$ (g) → $CO_2$ (g)
B) 2Ca (s) + $O_2$ (g) → 2CaO (s)
C) $C_2H_2$ (g) + $H_2$ (g) → $C_2H_4$ (g)
D) 2C (graphite) + $O_2$ (g) → 2CO (g)
E) 3Mg (s) + $N_2$ (g) → $Mg_3N_2$ (s)

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

25) Calculate the oxidation number of Cl in each of the following and indicate which species has the highest oxidation number of Cl. 25) _____

$HClO_4$ $NaClO_3$ $KClO_2$ KClO

26) If an equal number of moles of each of the following species were placed in water which would have the highest conductivity?
$MgCl_2$, NaCl, $K_2SO_4$, $Li_3PO_4$ 26) _____

27) The in class demonstration of ionic conductivity in water used a clear, colorless sugar solution and a white cloudy solution of salt (NaCl) water. Why was the salt water cloudy? 27) _____

28) An acid is defined as something which: 28) _____

29) Using the activity series, which lists which metals get oxidized the easiest, determine if the following reactions will occur or not: 29) _____

A) $Pb^{+2}_{(aq)} + Mg_{(s)} \dashrightarrow Pb_{(s)} + Mg^{+2}_{(aq)}$

B) $Fe^{+2}_{(aq)} + 2Na_{(s)} \dashrightarrow Fe_{(s)} + 2Na^{+}_{(aq)}$

C) $Ni_{(s)} + Ca^{+2}_{(aq)} \dashrightarrow Ni^{+2}_{aq)} + Li_{(s)}$

30) Calcium oxide reacts with water in a combination reaction to produce calcium hydroxide: 30) _____

$$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (s)$$

A 1.50–g sample of CaO is reacted with 1.45 g of $H_2O$. How many grams of water remains after completion of reaction?

31) A stock solution of $HNO_3$ is prepared and found to contain 13.5 M of $HNO_3$. If 25.0 mL of the stock solution is diluted to a final volume of 0.500 L, the concentration of the diluted solution is _____ M. 31) _____

32) The molarity (M) of an aqueous solution containing 22.5 g of glucose ($C_6H_{12}O_6$) in 35.5 mL of solution is _____. 32) _____

33) The value of $\Delta H°$ for the reaction below is –186 kJ. 33) _____

$$H_2\,(g) + Cl_2\,(g) \rightarrow 2HCl\,(g)$$

The value of $\Delta H_f°$ for HCl (g) is _____ kJ/mol.

34) The value of $\Delta H°$ for the reaction below is –482 kJ. Calculate the heat (kJ) released to the surroundings when 12.0 g of CO (g) reacts completely. 34) _____

$$2CO\ (g) + O_2\ (g) \rightarrow 2CO_2\ (g)$$

35) A sample of aluminum metal absorbs 9.86 J of heat, upon which the temperature of the sample increases from 23.2°C to 30.5°C. Since the specific heat capacity of aluminum is 0.90 J/g–K, the mass of the sample is _____ g. 35) _____

36) Calculate $\Delta H°$ (in kJ) for reaction 3. 36) _____

$$2S\ (s) + 3O_2\ (g) \rightarrow 2SO_3\ (g) \qquad \triangle H = -790\ kJ$$
$$S\ (s) + O_2\ (g) \rightarrow SO_2\ (g) \qquad \triangle H = -297\ kJ$$

the enthalpy of the reaction in which sulfur dioxide is oxidized to sulfur trioxide

$$2SO_2\ (g) + O_2\ (g) \rightarrow 2SO_3\ (g)$$

is _____ kJ.

1) B
2) B
3) B
4) E
5) E
6) E
7) A
8) E
9) E
10) D
11) C
12) C
13) D
14) B
15) C
16) A
17) B
18) A
19) D
20) D
21) C
22) A
23) A
24) E
25) 7, 5, 3, 1. HClO4 has the highest.
26) $Li_3PO_4$
27) The salt contains insoluble compounds to prevent the grains of salt from sticking together in humid weather.
28) increases the concentration of $H^+$ ions in aqueous solutions
29) a0 Yes, b) Yes, c) No
30) .970 g
31) 0.675
32) 3.52
33) –93.0
34) 103
35) 1.5
36) –196