Exam chapter 4-5 Exam D KEY

Name_____

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

1) Which of the following is insoluble in water at 25 °C? 1) _____

A) $Ca(OH)_2$
B) $(NH_4)_2CO_3$
C) $Ba(C_2H_3O_2)_2$
D) $Mg_3(PO_4)_2$
E) Na_2S

$C_2H_3O_2^-$ acetate

2) Which of the following are strong electrolytes? 2) _____

– HCl
$HC_2H_3O_2$
NH_3
– KCl

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

3) The balanced net ionic equation for precipitation of $CaCO_3$ when aqueous solutions of Na_2CO_3 and $CaCl_2$ are mixed is _____. 3) _____

A) $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(aq)$
B) $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$
C) $2Na^+(aq) + 2Cl^-(aq) \rightarrow 2NaCl(aq)$
D) $2Na^+(aq) + CO_3^{2-}(aq) \rightarrow Na_2CO_3(aq)$
E) $Na_2CO_3(aq) + CaCl_2(aq) \rightarrow 2NaCl(aq) + CaCO_3(s)$

$Ca^{2+} + CO_3^{2-}$

4) The net ionic equation for the reaction between aqueous nitric acid and aqueous sodium hydroxide is _____. 4) _____

A) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B) $H^+(aq) + HNO_3(aq) + 2OH^-(aq) \rightarrow 2H_2O(l) + NO_3^-(aq)$
C) $H^+(aq) + Na^+(aq) + OH^-(aq) \rightarrow H_2O(l) + Na^+(aq)$
D) $HNO_3(aq) + NaOH(aq) \rightarrow NaNO_3(aq) + H_2O(l)$
E) $HNO_3(aq) + OH^-(aq) \rightarrow NO_3^-(aq) + H_2O(l)$

$HNO_3 + NaOH \rightarrow$

H_2O

5) Which of the following are weak acids? 5) _____

A) HF, HBr
B) HI, HF
C) HI, HNO_3, HBr
D) HF
E) none of the above

6) Which of these metals will be oxidized by the ions of aluminum? 6) _____

A) zinc
B) chromium
C) magnesium
D) nickel
E) iron

7) The net ionic equation for the dissolution of zinc metal in aqueous hydrobromic acid is _____. 7) _____

A) $2Zn\ (s) + H^+\ (aq) \rightarrow 2Zn^{2+}\ (aq) + H_2\ (g)$
B) $Zn\ (s) + 2HBr\ (aq) \rightarrow ZnBr_2\ (aq) + 2H^+\ (aq)$
C) $Zn\ (s) + 2HBr\ (aq) \rightarrow ZnBr_2\ (s) + 2H^+\ (aq)$
D) $Zn\ (s) + 2Br^-\ (aq) \rightarrow ZnBr_2\ (aq)$
E) $Zn\ (s) + 2H^+\ (aq) \rightarrow Zn^{2+}\ (aq) + H_2\ (g)$

8) Oxidation is the _____ and reduction is the _____. 8) _____

A) gain of oxygen, loss of mass
B) gain of oxygen, loss of electrons
C) loss of electrons, gain of electrons
D) loss of oxygen, gain of electrons
E) gain of electrons, loss of electrons

9) Which of the following is an oxidation–reduction reaction? 9) _____

A) $H_2CO_3\ (aq) + Ca(NO_3)_2\ (aq) \rightarrow 2HNO_3\ (aq) + CaCO_3\ (s)$
B) $Cu\ (s) + 2AgNO_3\ (aq) \rightarrow 2Ag\ (s) + Cu(NO_3)_2\ (aq)$
C) $AgNO_3\ (aq) + HCl\ (aq) \rightarrow AgCl\ (s) + HNO_3\ (aq)$
D) $HCl\ (aq) + NaOH\ (aq) \rightarrow H_2O\ (l) + NaCl\ (aq)$
E) $Ba(C_2H_3O_2)_2\ (aq) + Na_2SO_4\ (aq) \rightarrow BaSO_4\ (s) + 2NaC_2H_3O_2\ (aq)$

10) A 0.200 M K_2SO_4 solution is produced by _____. 10) _____

A) dissolving 43.6 g of K_2SO_4 in water and diluting to a total volume of 250.0 mL
B) diluting 20.0 mL of 5.00 M K_2SO_4 solution to 500.0 mL
C) dissolving 20.2 g of K_2SO_4 in water and diluting to 250.0 mL, then diluting 25.0 mL of this solution to a total volume of 500.0 mL
D) dilution of 1.00 mL of 250 M K_2SO_3 to 1.00 L
E) dilution of 250.0 mL of 1.00 M K_2SO_4 to 1.00 L

11) How many grams of NaOH (MW = 40.0) are there in 500.0 mL of a 0.225 M NaOH solution? 11) _____

A) 114 B) 0.00219 C) 4.50 D) 14.0 E) 0.113

12) When a system _____, ΔE is always negative. 12) _____

A) gives off heat and has work done on it
B) absorbs heat and does work
C) gives off heat and does work
D) absorbs heat and has work done on it
E) none of the above is always negative.

13) ΔH for an endothermic process is _____ while ΔH for an exothermic process is _____. 13) _____

A) zero, negative
B) positive, negative
C) negative, positive
D) positive, zero
E) zero, positive

14) The specific heat capacity of liquid water is 4.18 J/g-K. How many joules of heat are needed to raise the temperature of 5.00 g of water from 25.1 °C to 65.3 °C? 14) _____

A) 48.1
B) 2.08×10^{-2}
C) 1.89×10^{3}
D) 54.4
E) 840

15) For which one of the following reactions is ΔH°_{rxn} equal to the heat of formation of the product? 15) _____

A) P (g) + 4H (g) + Br (g) → PH_4Br (l)
B) N_2 (g) + $3H_2$ (g) → $2NH_3$ (g)
C) $(1/2)N_2$ (g) + O_2 (g) → NO_2 (g)
D) 6C (s) + 6H (g) → C_6H_6 (l)
E) 12C (g) + $11H_2$ (g) + 11O (g) → $C_6H_{22}O_{11}$ (g)

16) The value of ΔH° for the reaction below is -126 kJ. The amount of heat that is released by the reaction of 20.0 g of Na_2O_2 with water is _____ kJ. 16) _____

$$2Na_2O_2\ (s) + 2H_2O\ (l) \rightarrow 4NaOH\ (s) + O_2\ (g)$$

A) -126 B) 67.5 C) 64.6 D) 32.3 E) 16.2

17) Given the following reactions 17) _____

Fe_2O_3 (s) + 3CO (s) → 2Fe (s) + $3CO_2$ (g) ΔH = -28.0 kJ

3Fe (s) + $4CO_2$ (s) → 4CO (g) + Fe_3O_4 (s) ΔH = +12.5 kJ

the enthalpy of the reaction of Fe_2O_3 with CO

$$3Fe_2O_3\ (s) + CO\ (g) \rightarrow CO_2\ (g) + 2Fe_3O_4\ (s)$$

is _____ kJ.

A) -15.5 B) +109 C) 40.5 D) -59.0 E) -109

18) Given the data in the table below, $\Delta H°_{rxn}$ for the reaction 18) _____

$$Ca(OH)_2 + 2H_3AsO_4 \rightarrow Ca(H_2AsO_4)_2 + 2H_2O$$

is _____ kJ.

Substance	$\Delta H_f°$ (kJ/mol)
$Ca(OH)_2$	-986.6
H_3AsO_4	-900.4
$Ca(H_2AsO_4)_2$	-2346.0
H_2O	-285.9

A) -130.4 B) -76.4 C) -744.9 D) -4519 E) -4219

19. In which of the following compounds is sulfur's oxidation state 4+?

(A) SCl_2 **(C)** $Cr_2(SO_4)_3$ **(E)** SO_3

(B) H_2S **(D)** $CaSO_3$

20. A 2.200 g sample of a hydrocarbon ($C_6H_4O_2$) is burned in a bomb calorimeter whose total heat capacity is 7.84 KJ / °C.

$$C_6H_4O_2\,(g) + 7O_2\,(g) \longrightarrow 6CO_2\,(g) + 2H_2O\,(g)$$

The temperature of the bomb calorimeter increased from 23.44 °C to 30.57 °C. What is the heat of combustion per gram of $C_6H_4O_2$?

(A) -25.5 kJ **(C)** -24.0 kJ **(E)** -56.0 kJ

(B) -240 kJ **(D)** -30.0 kJ

21. Silver metal is added to a solution of copper (II) nitrate, in the chemical reaction that occurs copper (II) ion:

(A) precipitates **(C)** is reduced **(E)** no reaction occurs

(B) is a spectator ion **(D)** is oxidized

3] $CaCl_2 + Na_2CO_3 \rightarrow$

$CaCO_{3(s)} + 2NaCl$

$Ca^{2+} + CO_3^{2-} \rightarrow CaCO_{3(s)}$

4] $HNO_3 + NaOH \rightarrow$

$H_2O + NaNO_3$

$H^+ + NO_3^- + Na^+ + OH^- \rightarrow$

$H_2O + Na^+ + NO_3^-$

$H^+ + OH^- \rightarrow H_2O$

7] $Zn + 2HBr \rightarrow ZnBr_2 + H_2$

$Zn + 2H^+ + 2Br^- \rightarrow$

$Zn^{2+} + 2Br^- + H_2$

$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$

9] $\overset{0}{Cu} + \overset{+1}{2AgNO_3} \rightarrow \overset{2+}{Cu(NO_3)_2} + \overset{0}{2Ag}$

10] $M_1V_1 = M_2V_2$

$$\left(\frac{0.5\,mol}{L}\right)(0.02L) = (M_2)(0.5$$

$M_2 = 0.2M\ K_2SO_4$

11] $0.5L\ NaOH \times \frac{0.225\,mol\ NaO}{1L} \times \frac{40g\ NaOH}{1mol} = 4.5g\ NaOH$

14

$$q = mc\Delta T$$

$$= (5g)\left(\frac{4.18J}{g\,^\circ C}\right)(65.3 - 25.1$$

$$q = 840J$$

16

$$2Na_2O_2 + 2H_2O \rightarrow$$

$$4NaOH + O_2 \quad \Delta H^\circ = -126k$$

$$20g\ Na_2O_2 \times \frac{1mol}{78g} \times \frac{-126kJ}{2mol} =$$

$$-16.2\ kJ$$

17]

$$3\,Fe_2O_3 + 9\,CO \rightarrow 6\,Fe + 9\,CO_2 \quad 3(-28\ kJ)$$

$$6\,Fe + 8\,CO_2 \rightarrow 8\,CO + 2\,Fe_3O_4 \quad 2(+12.5)$$

$$3\,Fe_2O_3 + CO \rightarrow CO_2 + 2\,Fe_3O_4 \quad -59\ kJ$$

18] $Ca(OH)_2 + 2\,H_3AsO_4 \rightarrow Ca(H_2AsO_4)_2 + 2\,H_2O$

$$\Delta H_{rxn} = [-2346\ kJ + 2(-285.9\ kJ)] - [2(-900.4\ kJ) + (-986.6)]$$

$$= -130.4\ kJ$$

20

$$C_6H_4O_2 + 7O_2 \rightarrow 6CO_2 + 2H_2O$$

$$q = c\Delta T$$

$$= \left(7.84\ \frac{kJ}{C^\circ}\right)(30.57 - 23.44)$$

$$= 55.89\ kJ$$

$$= \frac{55.89\ kJ}{2.2\ g}$$

$$= -25.5\ kJ$$