♥♥The second exam for chemistry 101 ♥♥

2021

(Past paper)

Good luck! <3

By: Nagham Sweidan♥

1. If 636.0mL of nitrogen gas, measured at 488.9mmHg and 22.3°C, reacts with excess iodine according to the following reaction, what mass of nitrogen triiodide is produced? $N_2(g)+3I_2(s)\rightarrow 2NI_3(s)$
   a. 3.33
   b. 0.472g
   c. 176g
   d. 13.3g
   e. 6.66g

   ANSWER: B

2. Using two or more of the following,

   $N_2(g)+3/2O_2(g)\rightarrow N_2O_3(g);\Delta H°=83.7KJ$

   $N_2(g)+O_2(g)\rightarrow 2NO(g);\ H°=180.4KJ$

   $1/2N_2(g)+O_2(g)\rightarrow NO_2(g);\Delta H°=33.2KJ$

   $1/2N_2(g)+3/2H_2(g)\rightarrow NH_3(g);\Delta H°=45.9KJ$

   Determine $_{\Delta}H°$ for the following reaction.

   $NO(g)+NO_2(g)\rightarrow N_2O_3(g)$

   a. -207.1kj
   b. 207.1kj
   c. 39.7kj
   d. 24.3kj
   e. -39.7kj

   ANSWER: B

3. When the value between the 2.00-L bulb, in which the gas pressure is 2.50 atm, and the 3.00-l bulb, in which the gas pressure is 1.50 atm, is opened, what will be the final pressure in the two bulbs? Assume the temperature remains constant.
    a. 4.00atm
    b. 2.17atm
    c. 1.83atm
    d. 2.10atm
    e. 1.90atm

4. What volume of ammonia gas, measured at 547.9mmHG and 27.6°C is required to produce 8.98g of ammonium sulfate according to the following balanced chemical equation?

$2NH_3+H_2SO_4(aq)\rightarrow(NH_4)SO_4(s)$

    a. 0.00397 L
    b. 18L
    c. 4.65L
    d. 1.16L
    e. 0.000992L

5. When 50.0, L of 1.27M of HCl(aq) is combined with 50.0mL of 1.32M of NaOH(aq) in a coffee-cup calorimeter, the temperature of the solution increases by 8°C. what is the change in enthalpy for this balanced reaction? $HCl(aq)+NaO(aq)\rightarrow NaCl(aq)+H_2O(l)$; assume

that the solution density is 1.00g/mL and the specific heat capacity of the solution is 4.18J/g. °C

a. 55.8KL
b. -51.5KJ
c. -55.8KJ
d. 51.5KJ
e. -26.8KJ

6. When 56.8g of lead reacts with 3.50L of oxygen gas, measured at 1.00atm and 25.0°C, 60.1KJ of heat is released at constant pressure. What is $\Delta H°$ for this reaction? (R=0.0821L.atm/(K.mol))

$2Pb(s)+O2(g)\rightarrow 2PbO(s)$

7. How much heat is evolved upon the complete oxidation of 6g of aluminum at 25°C and 1atm pressure?

(For Al2O3 is -1676KJ/mol)$4Al(s)+3O2(g)\rightarrow 2Al2O3(s)$)

a. 85.59kJ
b. 171.1kJ
c. 342.3kJ
d. 684.7kJ
e. 9.238x10^3 KJ

ANSWER: B

8. 86.9-g sample of chromium (s=0.447J/(g. °C)), initially at 338.33°C, is added to an insulated vessel containing

189.9g of water (s=4.18J/(g.°C)) initially at 16.17°C.At equilibrium, the final temperature of the metal-water mixture is 28.06°C. how much heat was absorbed by the water? The heat capacity of the vessel is 0.220KJ/°C.

a. 9.43KJ
b. 15.2KJ
c. 12KJ
d. 6.82KJ
e. 112KJ

9. A sample of hydrogen was collected by water displacement at 23.0°C and an atmospheric pressure of 735mmHG.Its volume is 568mL. After water vapor is (removed), what volume would the hydrogen occupy at the same conditions of pressure and temperature? (The vapor pressure of water at 23.0°C is 21mmHG).

a. 552mL
b. 509 mL
c. 568mL
d. 585mL
e. 539Ml

10. A small amount wet of hydrogen gas (H2) can be prepared by the reaction of zinc with excess hydrochloric acid and trapping the gas produced in an inverted tube initially filled with water. If the total pressure of the gas in the collection tube is 757.9mmHG at 25°C, what is the

partial pressure of the hydrogen? The vapor pressure of water is 23.8mmHG.

a. 781.7mmHG
b. 734.1mmHG
c. 47.7mmHG
d. 32.8mmHG
e. 757.9mmHG

11. What volume of sulfur trioxide gas, SO3, has the same number of atoms 4L of helium gas at the same temperature and pressure?

a. 4L
b. 20L
c. 16L
d. 1L
e. 0.8L

12. In a certain experiment,0.7000 mol of hydrogen gas reacted with 0.7000 mol of solid iodine at a constant 1 atm pressure, producing 1 4000 mol of solid hydrogen iodide and absorbing 36.9KJ of heat in the process, which of the following thermochemical equations correctly describes this experiment?

a. $H2(g)+I2(s)\rightarrow 2HI(s), \Delta H^\circ = 73.8KJ$

b. $H2(g)+I2(s)\rightarrow 2HI(s), \Delta H^\circ = -36.9KJ$

c. $H2(g)+I2(s)\rightarrow 2HI(s), \Delta H^\circ = 36.9KJ$

d. $H_2(g)+I_2(s) \rightarrow 2HI(s), \Delta H^\circ = -52.72KJ$

e. $H_2(g)+I_2(s) \rightarrow 2HI(s), \Delta H^\circ = -52.72KJ$

13. a bomb calorimeter has a heat capacity of 2.47KJ/K. When a0.106-g sample of certain hydrocarbon was burned in this calorimeter, the temperature increased by 2.14K. calculate the energy of combustion for 1g of the hydrocarbon?

a. -2.33x10^3 J/g
b. -0.560 J/g
c. -4.99x10^5 J/g
d. -5.29 J/g
e. -0.120 J/g

14. What is the partial pressure of carbon dioxide in a container that contains 3.63 mol of oxygen, 1.49 mol of nitrogen, and 4.49 mol of carbon dioxide when the total pressure is 871 mmHG?

a. 871mmHG
b.135mmHG
c. 329mmHG
d. 406mmHG
e. 763mmHG

15) Given the following thermochemical data at 25°C and 1 atm pressure,

$3/2O_2(g)+2B(s) \rightarrow B_2O_3(s); \Delta H^\circ = -1264KJ$

$O_3(g)+2B(s)\rightarrow B_2O_3(s)$; $\Delta H°=-1406KJ$

Determine H° for the following reaction at 25°C and 1 atm pressure. $3O_2(g)\rightarrow 2O_3(g)$

a. +980KJ/mol
b. +284KJ/mol
c. -284KJ/mol
d. -980KJ/mol
e. -2670KJ/mol

16) At 25°C, the standard enthalpy of combustion of gaseous propane (C_3H_8) is -2219.0KJ per mole of propane, and the standard enthalpy of combustion of gaseous propylene (C_3H_6) is -2058.3KJ per mole of propylene. What is the standard enthalpy change for the following reaction at 25°C? $C_3H_6(g)+H_2(g)\rightarrow C_3H_8(g)$;

Substance	$\Delta H°f$(KJ/mol)
$CO_2(g)$	-393.5
$H_2O(l)$	-285.8

a. -20.4KJ
b. -150.7KJ
c. +104.7KJ
d. +160.7KJ
e. e. -125.1KJ

17. How much heat is liberated at constant pressure 0.833g of calcium carbonate reacts with 59.7 mL of 0.251M hydrochloric acid?

$CaCO3(s)+2HCl(aq)\rightarrow CaCL2(aq)+H2O(l)+CO2(g);\Delta H^{\circ}=-15.2KJ$

a.0.113KJ
b.0.526KJ
c.3.81KJ
d.12.6KJ
e.0.24 KJ

18. which of the following is/are true of Avogadro's law?

1. Avogadro's law relates the volume of a gas to the moles of the gas at constant temperature and pressure

2. Avogadro's law states that the pressure of a gas decreases if the volume is increased at constant temperature and molar concentration

3. Avogadro's law states that the pressure of a gas increases with the increase in its temperature at constant volume and molar concentration

a. 1 and3
b. 3 only
c. 2 only
d. 1 only
e. 2 and 3

19. How many values are there for the magnetic quantum number when the value of the angular momentum quantum number is 3?

a. 7
b. 14
c.15
d.1
e.12

20. Which of the following statements is true concerning the decomposition of liquid water to form hydrogen gas and oxygen gas?
$2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

a. ΔH is greater than ΔU because of the pressure-volume work done by the gaseous products

b. ΔH is less than ΔU because the atmosphere does pressure-volume work on the gaseous products

c. ΔH is less than ΔU because of the pressure-value work done by the gaseous products

d. ΔH is greater than ΔU because the pressure is constant

e. ΔH equals ΔU because both are state functions

21. Absolute zero is the point at which?
a. a straight-line graph of V versus T(K) intersects the origin
b. a straight-line graph of V versus 1/P at constant T intersects the origin
c. gaseous helium liguefies
d. a straight-line graph of V versus T(∞C) intersects the origin
e. a straight-line graph of 1/V versus P at constant T intersects the origin

22) calcium nitrate react with ammonium chloride at slightly elevated temperatures, as represented in the equation below.

$Ca(NO2)2(s)+2NH4Cl(s)\rightarrow 2N2O(g)+CaCl2(s)+4H2O(g)$;
What is the maximum volume of N2O at STP that could be produced using a 5.20-mol sample of each reactant?

a. 233L
b. 1.42x10^3 L
c. 22.4L
d. 116L
e. 8.58X10^-3 L

23. The reaction of iron hydrochloric acid is represented by the following thermochemical equation.

Fe(s)+2HCl(aq)→FeCl2(aq)+H2(g); ΔH∞=-87.9KJ; How much heat is liberated at constant pressure if 0.154g of iron reacts with 25.7mL of 0.358M HCl?

a. 0.404KJ
b. 13.5KJ
c. 1.85KJ
d. 87.9KJ
e. 0.242KJ

24. A 500-cm^3 sample of1.0 M NaOH(aq)is added to 500cm3 of 1.0M HCl(aq)in a Styrofoam cup, and the solution is quickly stirred. The rise in temperature (ΔT1) is measured. The experiment is repeated using 100cm^3 of each solution, and the rise in temperature (ΔT2) is measured. What conclusion can you draw about ΔT1 and ΔT2? HCl(aq)+NaOH(aq) H2O(l)+NaCL(aq);ΔH∞=-55.8KJ

a. ΔT1 is five times as large as ΔT2
b. ΔT1 is less than ΔT2
c. ΔT2 is greater than ΔT1
d. ΔT2 is equal to ΔT1
e. ΔT2 is five times as large as ΔT1

25. In a mixture of helium and chlorine, occupying a volume of 12.8L at 605.6mmHg and 21.6∞C, it is found that the partial pressure of chlorine is 143mmHg. What is the total mass of the sample?

a. 31.6g
b. 7.09g
c.1.28g
d.0.4g
e. 8.37g

26. What is the standard enthalpy change for the combustion of liquid cyclopentane, C_5H_{10}?

$2C_5H_{10}(l)+15O_2(g)\rightarrow 10CO_2(g)+10H_2O(l)$

$C_5H_{10}(l)\Delta H^{\infty}f(KJ/mol)$ -105.6

$CO_2(g)$ $\Delta H^{\infty}f(KJ/mol)$ –393.5

$H_2O(l)$ $\Delta H^{\infty}f(KJ/mol)$ -285.8

a.+784.9KJ

b. +573.7KJ

c.-784.9KJ

d.-6581.8KJ

e.-573.7KJ

27. What does the standard enthalpy change for the following reaction?

$N_2H_4(l)+2NO_2(g)\rightarrow 2N_2O(g)+2H_2O(l)$

$N_2H_4(l)$ $\Delta H^{\infty}f(KJ/mol)$ +50.6

$N_2O(g)\Delta H^{\infty}f(KJ/mol)$ +33.1

$N_2O(g)\ \Delta H^\infty f(KJ/mol)$ +82.1

$H_2O(l)\ \Delta H^\infty f(KJ/mol)$ -285.8

a. -119.7KJ
b. +290.6KJ
c. -524.2KJ
d. -290.6KJ
e. +119.7KJ

ANSWER: D

28. when 9.42g of methane (CH_4) is burned in a bomb calorimeter (heat capacity=2.677x10^3 J/∞C), the temperature rises from 24.00 to 27.08∞C, How much heat is absorbed by the calorimeter?

$CH_4(g)+CO_2(g)\rightarrow CO_2(g)+2H_2O(l)$ ΔH^∞=-1283.8

a. 753KJ
b. 8.24KJ
c. 1.28X10^3KJ
d. 4.84X10^3KJ
e. 745KJ

29. What volume of ammonia gas, measured at 547.9 mmHg and 27.6∞C, is required to produce 8.98g of ammonium sulfate according to the following balanced chemical equation?

$2NH_3(g)+H_2SO_4(aq)\rightarrow (NH_4)_2SO_4(s)$

a. 0.000992L
b. 1.16L
c. 4.65L
d. 0.00397L
e. 18L

ANSWER: C

30. At 530.4 mmHg and 55.3∞C, a 3.14-L sample of a hydrocarbon gas has a mass of 2.28g. What is the formula of the gas?

a. C2H6
b. C2H2
c.C2H4
d.C3H6
e.C3H8

ANSWER: C

31. When 13.8 mL of 0.870M lead (2) nitrate reacts with 90.0mL of 0.777M sodium chloride, 0.279KJ of heat is released at constant pressure. What is ΔH∞ for this reaction?

$Pb(NO_3)_2(aq)+2NaCl(aq)\rightarrow PbCl_2(s)+2NaNO_3(aq)$

a. 23.3KJ
b. 4KJ
c. 1.84KJ
d. 8KJ
e. 3.41KJ

ANSWER: C

32. If 250 Ml of methane, CH_4, effuses through a small hole in 20 s, the time required for the same volume of helium to pass through the hole under the same conditions will be

a. 10 s
b. 1.3s
c. 40 s
d. 5 s
e. 80 s

33. Under conditions of constant pressure, for which of the following reactions is the magnitude of a pressure-volume work going to be the greatest?

a. $2H_2O_2(l) \rightarrow 2H_2O(l)+O_2(g)$

b. $BaO(S)+SO_3(g) \rightarrow BaSO_4(s)$

c. $2NO(g)+O_2(g) \rightarrow 2NO_2(g)$

d. $2KClO_3(s) \rightarrow 2KCl(s) +3O_2(g)$

e. $H_2(g)+Cl_2(g) \rightarrow 2HCl(g)$

ANSWER: D

34. Which f the following processes will result in the lowest final temperature of the metal-water mixture at equilibrium? The specific heat of cobalt is $0.421 J/g(g.\infty C)$

a. the addition of 100 g of cobalt at 95∞C to 40mL of water at 25∞C in an insulated container

b. the addition of 100 g of cobalt at 95∞C to 80mL of water at 25∞C in an insulated container

c. the addition of 100 g of cobalt at 95∞C to 100mL of water at 25∞C in an insulated container

d. the addition of 100 g of cobalt at 95∞C to 60mL of water at 25∞C in an insulated container

e. the addition of 100 g of cobalt at 95∞C to 20mL of water at 25∞C in an insulated container

35. When 22.0 mL of liquid benzene (C6H6, d=0.879 g/mL) reacts with 34.2L of oxygen gas, measured at 1.00 atm pressure and 25C, 6.09x10^2 KJ of heat is released at constant pressure.

What is H for the following reaction? (R=0.0821 L.atm/(K.mol))

$2C_6H_6(l)+15O_2(g)\rightarrow 12CO_2(g)+6H_2O(l)$

a. -4.92x10^3 KJ
b. -2.84x10^1 KJ
c. -4.36x10^2 KJ
d. -6.53x10^3 KJ
e. -3.7x10^2 KJ

36. Using the following data, calculate the standard enthalpy of reaction for the coal gasification process

$2C(s)+2H_2O(g)\rightarrow CH_4(g)+CO_2(g)$,

$C(s)+H_2O(g)\rightarrow CO(g)+H_2(g)$; $\Delta H^{\infty}=+131.3KJ$;

$CO(g)+H_2O(g)\rightarrow CO(g)+H_2(g)$; $\Delta H^{\infty}=-41.2KJ$;

$CO(g)+3H_2(g)\rightarrow CH_4(g)+H_2O(g)$; $\Delta H^{\infty}=-206.1KJ$;

a. +15.3KJ
b. -378.6KJ
c. -157.26KJ
d. +378.6KJ
e. -116.0KJ

37. The reaction of iron hydrochloric acid is represented by the following thermochemical equation.

$Fe(s)+2HCl(aq)\rightarrow FeCl_2(aq)+H_2(g)$; $\Delta H^{\infty}=-87.9KJ$;In which of the following experiments would the temperature rise the most?

a. 1.1 g of Fe added to 1.0 L of 0.02 M HCl
b. 1.1 g of Fe added to 1.0 L of 0.02 M HCl
c. 0.56 g of Fe added to 1.0 L of 0.02 M HCl
d. 2.2 g of Fe added to 1.0 L of 0.03 M HCl
e. 4.5 g of Fe added to 1.0 L of 0.03 M HCl

38. What is the number of subshells found in the n=6 shell?

a. 7
b. 36
c. 5
d. 6
e. 8

ANSWER: D

39. A 8.22-g sample of solid calcium reacted in excess fluorine gas to give a 16-g sample of pure solid CaF2. The heat given off in this reaction was 251KJ at constant pressure. Given this information, what is the enthalpy of formation of CaF2(s)?

a. 251 KJ/mol
b. -1.23x10^3 KJ/mol
c. -613KJ/mol
d. 1.23x10^3 KJ/mol
e -251KJ/mol

40. When 0.0500 mol of HCl(aq)is reacted with 0.0500 mol of NaOH (aq) in 50.0 mL of water, the temperature of the solution increases by 5.99∞C. What is the enthalpy for the following thermochemical equation?
HCl(aq)+NaOH(aq)→ NaCl(aq)+H2O(l); Assume that the heat capacity of the solution and calorimeter is 465.4J/∞C.

a. 2.79KJ
b. -55.8KJ
c. -0.139KJ
d. 55.8KJ

e. -2.79KJ

41. The volume of a sample of gas measured at 35.0∞C and 1.00 atm pressure is 2.00L. What must the final temperature be in order for the gas to have a final volume of 3.00 L at 1.00 atm pressure?

a. 52.5∞C
b. 189.0∞C
c. -220.5∞C
d.23.3∞C
e.-67.8∞C

ANSWER: B

42. The partial pressure of CH4,n2, in a sample of gas were found to be 183 mmHg. 443mmHg, and 693 mmHg, respectively. What is the mole fraction of nitrogen?

a. 0.525
b.0.336
c.0.410
d.21.7
e.0.912

ANSWER: B

Chemistry 101

Second Exam 020

Done by:

Shahed Atiyat

1.Based on the solubility rules, which one of these compounds should be soluble in water?

a. FeS

b. $Pb(NO_3)_2$

c. $PbCl_2$

d. Ag_2SO_4

e. $CaCO_3$

2. Given the data in the table below calculate $\triangle H^o f$ (KJ) for the reaction:
$2CH_3OH(l) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(l)$

Substance	*$\triangle H^o f$(KJ/mol)*
CH_3OH	*-249*
CO_2	*-393*
$H_2O(l)$	*-286*

a. -1432

b. -1412

c. -1452

d. -1392

e. -1372

3. Given the following thermochemical equation:

$2S(s) + 3O_2(g) \rightarrow 2SO_3(g) \quad \triangle H = -792$ KJ

$S(s) + O_2(g) \rightarrow SO_2(g) \quad \triangle H = -297$ KJ

Calculate $\triangle H$(in KJ) for the reaction:

$SO_2(g) + ½\ O_2(g) \rightarrow SO_3(g)$

a. -139

b. -99

c. -119

d. -109

e. -129

4. Use the kinetic molecular theory of gases to predict what would happen to a closed sample of a gas whose temperature decreased while its volume increased?

a. Its pressure would hold constant

b. Its pressure would increase

c. Its pressure would decrease

d. The average kinetic energy of the molecules of the gas would increase

e. The number of moles of the gas would decrease

5. Calculate the density of hydrogen at STP.

a. 0.810 g/L

b. 0.0613 g/L

c. 0.0761 g/L

d. 1.54 g/L

e. 0.0893 g/L

6. Which one of these equations a redox reaction?

a. $CaBr(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 3HBr(g)$

b. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

c. $CO_3^{2-} + HSO_4^-(aq) \rightarrow HCO_3^-(aq) + SO_4^{2-}(aq)$

d. $Cu(s) + 3AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$

e. $2KBr(aq) + Pb(NO_3)_2(aq) \rightarrow 2KNO_3(aq) + PbBr_2(s)$

7. Gaseous C_2H_4 reacts with O_2 according to the following equation:

$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$

What volume of oxygen at STP is needed to react with 1.50 mol of C_2H_4?

a. 67.2 L

b. 22.1 L

c. 33.6 L

d. 101 L

e. 4.50 L

8. Oxygen gas, generated by the reaction $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2$, is collected over water at 27 ^oC in a 1.40 L vessel at a total pressure of 760 torr. (The vapor pressure of H_2O at 27 ^oC in 26.0 torr). How many moles of $KClO_3$ were consumed in the reaction?

$R = 0.0821\ L\ atm\ mol^{-1}\ K^{-1}$

a.0.0841 moles

b. 0.0265 moles

c. 0.0366 moles

d. 0.0703 moles

e. 0.0169 moles

9. The oxidation number of Mn in $KMnO_4$ is:

a. 2+

b. 7+

c. 1+

d. 4+

e. 5+

10. A sample of N_2 gas is mixed with a gas (A) of unknown molar mass. The partial pressure of each gas is known to be 200 torr at 25 ^oC. The gases are allowed to effuse through a pinhole, and it is found that gas A escapes at 1.2 times the rate of N_2. The molar mass of gas A is:

a. 252

b. 9.33

c. 23.2

d. 19.4

e. 84.0

11.How much heat (in KJ) is produced when 85.0 g of $NH_3(g)$,(Molar mass= 17.0 g/mol), are oxidized according to:

$4NH_3(g) + 7O_2(g) \rightarrow 4NO_2(g) + 6H_2O(g)$ $\triangle H$= -1396 KJ

a. 698

b. 1745

c. 1047

d. 1396

e. 2094

12. A 4.50 g sample of sugar $C_5H_{10}O_5$ (molar mass= 150.0 g/mol) was burned in excess oxygen in a bomb calorimeter according to:

$C_5H_{10}O_5(s) + 5O_2(g) \rightarrow 5CO_2(g) + 5H_2O(l)$

If the heat capacity of the calorimeter and its contents was 16.0 KJ/ ^oC, and the temperature rose from 25.0 ^oC to 26.5 ^oC, calculate $\triangle H$ in K/mol for the combustion reaction.

a. -1600

b. -960

c. -800

d. -2400

e. -1200

13. A solution contains 0.600% (by mass) or (mass/mass) NaBr (sodium bromide) (molar mass= 102.89 g/mol). The density of the solution is 1.046 g/cm^3. What is the molarity of the NaBr solution?

a. 0.0610

b. 0.0583

c. 0.583

d. 0.0280

e. 0.610

14. Which of the following is included as postulate in the kinetic molecular theory of an ideal gas?

a. The distance between gas molecules is small compared with the size of the molecule

b. In an average collision between molecules, both molecules have the same kinetic energy.

c. Collision between molecules is all elastic

d. All molecules move randomly in zigzag direction

e. All the molecules have the same velocity

15. The oxidation number of P in $Ba_3(PO_3)_2$ is:

a. +2

b. +1

c. +4

d. +5

e. +3

16. A stock solution of potassium dichromate, $K_2Cr_2O_7$ (Molar mass= 294.185 g/mol) is made by dissolving 84.50 g of the compound in 1L of solution. How many milliliters of this solution are required to prepare 1 dm^3 of 0.0600 M $K_2Cr_2O_7$?

a. 430

b. 52.2

c. 261

d. 522

e. 209

17. In a process 455 KJ of heat were evolved and 656 KJ of work were done on the system. Calculated △U (KJ) for the system.

a. 201

b. 601

c. 401

d. 501

e. 301

ANSWERS

1	B	**10**	D
2	A	**11**	B
3	B	**12**	C
4	A	**13**	A
5	E	**14**	C
6	D	**15**	E
7	D	**16**	E
8	C	**17**	A
9	B		

GOOD LUCK 💚

Second Exam 022

SECOND EXAM 23

Calculate the standard enthalpy change (in kJ) for the following reaction

$$NO_2(g) + H_2(g) \rightarrow NO(g) + H_2O(g)$$

A) 51.1 kJ

B) 61.1 kJ

C) 71.1 kJ

D) 81.1 kJ

E) 91.1 kJ

Compound	ΔH°_f (kJ/mol)
$NO_2(g)$	−433.4
$NO(g)$	−110.5
$H_2O(g)$	−241.8

Answer : D

In the following reaction: C2H5OH + 3O2 → 2CO2 + 3H2O, the enthalpy change of the reaction is found to be **ΔH°=-**1250 kJ. How many grams of oxygen molecules must (32 g/mol) be reacted by this reaction to release 10^4 kJ of heat?

A) 914 g
B) 835 g
C) 768 g
D) 711 g
E) 662 g

Answer : C

A sample of a gas occupies 1,400 × 10^3 ml. At 25°C and 880 mm Hg. What volume will it occupy at the same temperature and 380 mmHg?

A. 2800 ml.
B. 2947 ml.
C. 3095 ml
D. 3242 ml.
E. 3389 ml.

Answer:D

What volume of CO_2 gas at 600 torr and 820 K could be produced by the reaction of 50 g of $CaCO_3$ (100.1 g/mol) according to the equation?

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

A. 34.8 L
B. 42.6 L
C. 52.4 L
D. 64.3 L
E. 79.2 L

Answer B

10.0 g of NaCl (58.44 g/mol) at 20.00 °C was added to a calorimeter containing 200 g of water at 20.00 °C. The temperature of the solution decreased to 17.30 °C. If the specific heat of the mixture is 4.184 $J.g^{1}°C^{1}$, the density of water is 1 g/mL, and the heat capacity of the calorimeter is ignored, what is the heat absorbed per mole of NaCl?

A) 10.8 kJ
B) 11.8 kJ
C) 12.8 kJ D) 13.9 kJ
D) 14.9 kJ

Answer D

A bomb calorimeter has a heat capacity of 2.47 kJ/°C. When a 0.106 g sample of a compound was burned in this calorimeter, the temperature increased by 2.44 °C. Calculate the energy of combustion for 1 g of the hydrocarbon.

A) -49.9 kJ

B)-52.2 kJ

C)-54.5 kJ

D)-56.9 kJ

E)-59.2 kJ

Answer: D

A mixture of three gases has a total pressure of 1650 mmHg at 298 K. The mixture found to contain 1.52 mol CO_2, 3.55 mol CO, and 1.89 mol Ar. What is the partial pressure of Ar?

A. 356 mmHg

B. 722 mmHg

C. 302 mmHg

D. 448 mmHg

E. 842 mmHg

Answer: D

If 417 J of heat is added to a system, and the change in internal energy was 254 J. Calculate the work involved with the change.

a) −231 J
b) −163 J
c) +1067 J
d) −1067 J
e) +231 J

- heat added to system = absorbed = $\boxed{+417}$

- $\Delta U = q + w$

$w = \Delta U - q = 254 - 417 = \boxed{-163}$

(b)

Consider the reaction:

$C_2H_4O_{2(l)} + 2\ O_{2(g)} \rightarrow 2\ H_2O_{(l)} + 2CO_{2(g)}$ $\Delta H° = -875$ kJ

Given $\Delta H_f°$ of $H_2O_{(l)} = -286$ kJ/mol
$C_2H_4O_{2(l)} = -485$ kJ/mol
Calculate $\Delta H_f°$ for $CO_{2(g)}$, (in kJ/mol).

a) −394
b) −344
c) −294
d) −244
e) −444

$$C_2H_4O_2 + 2O_2 \longrightarrow 2H_2O + 2CO_2$$

$$\Delta H^\circ_{rxn} = -875 \text{ KJ}$$

H_2O	$\Delta H_f^\circ = -286$ KJ
$C_2H_4O_2$	$\Delta Hf^\circ = -485$ KJ

$$\Delta H^\circ_{f\,rxn} = \sum \Delta H^\circ_{f\,(products)} - \sum \Delta H^\circ_{f\,(reactants)}$$

$$-875 = (2 \times \Delta H^\circ_{f\,CO_2} + 2 \times \Delta H^\circ_{f\,H_2O}) - (2 \times \Delta H^\circ_{f\,O_2} + 1 \times \Delta H^\circ_{f\,C_2H_4O_2})$$

$$-875 = (2 \times X + 2 \times -286) - (2 \times 0 + 1 \times -485)$$

$$\boxed{X = -394}$$

A sample of 1.43 g of naphthalene ($C_{10}H_8$, molar mass = 128 g/mol) was burned in excess oxygen in a bomb calorimeter. The temperature of the calorimeter increased from 20.28 °C to 25.95 °C. If the heat evolved from the reaction was 5632 kJ/mol. Calculate the heat capacity of the calorimeter.

$$C_{10}H_{8(s)} + 12\ O_{2(g)} \rightarrow 4\ H_2O_{(l)} + 10\ CO_{2(g)}$$

11.1 kJ/K
18.4 kJ/K

b) 20.9 kJ/K
e) 9.54 kJ/K

c) [illegible]

- heat of reaction means :

$$C_{10}H_8 + 12O_2 \longrightarrow 4H_2O + 10CO_2 \quad \Delta H = -563 \text{ KJ}$$

so, when we react 1.43 g we are going to do stichemtry

نسبة وتناسب

$$1 \text{ mol } C_{10}H_8 \longrightarrow -5632 \text{ KJ}$$

$$\frac{1.43}{128} \longrightarrow x \quad \Rightarrow \quad \boxed{x = -62.92}$$

$$q_{rxn} = -q_{calorimeter}$$

$$-62.92 = -C \times \Delta t$$

$$-62.92 = -C \times (25.95 - 20.28)$$

$$C = 11.09$$

* في الاجوبة عنا الوحدة KJ/K وعنا ما انه جول الحرارة من ℃ ← K° وهذا الشي خزعة عشان تضييع الوقت ، لا تخاف هي نفسها KJ/℃ أو KJ/K° .

Sort the following gases at the same conditions in ascending order (تصاعدياً) according to their densities.

Ne, O_2, F_2, Cl_2

a) $Ne < F_2 < O_2 < Cl_2$
b) $Cl_2 < O_2 < Ne < F_2$
c) $Cl_2 < F_2 < O_2 < Ne$
d) $Ne < O_2 < F_2 < Cl_2$
e) $O_2 < F_2 < Cl_2 < Ne$

$$\text{density} = \frac{P M.w}{RT} \rightarrow \text{density} \uparrow \text{, } M.w \uparrow$$

$Cl_2 > F_2 > O_2 > Ne$

M.w $70.9 \frac{g}{mol}$ $38 \frac{g}{mol}$ $32 \frac{g}{mol}$ $20.2 \frac{g}{mol}$

(d)

A sample of oxygen gas (O_2) was found to effuse at a rate equal to three times as that of an unknown gas. The molecular weight of the unknown gas is

a) 288 g/mol
b) 388 g/mol
c) 550 g/mol
d) 400 g/mol
e) 101 g/mol

$$\frac{r_{O_2}}{r_A} = \sqrt{\frac{M.w_A}{M.w_{O_2}}}$$

A : unknown gas

but $\boxed{r_{O_2} = 3\, r_A}$

$$\frac{3\, r_A}{r_A} = \sqrt{\frac{M.w_A}{32}} \Rightarrow \boxed{M.w_A = 288 \frac{g}{mol}}$$

(9)

What are the quantum numbers that represents the subshell denoted by 4s

a) $n = 0, l = 4$
b) $n = 4, l = 1$
c) $n = 1, l = 4$
d) $n = 4, l = 2$
e) $n = 4, l = 0$

- 4s represents by $n = 4$, $L = 0$

(e)

One of the following combination of quantum numbers is allowed:

a) $n = 1,\ l = 2,\ ml = -1,\ m_s = +1/2$
b) $n = 2,\ l = 2,\ ml = 0,\ m_s = +1/2$
c) $n = 3,\ l = 2,\ ml = -1,\ m_s = -1/2$
d) $n = 2,\ l = 1,\ ml = +1,\ m_s = 0$
e) $n = 0,\ l = 0,\ ml = 0,\ m_s = +1/2$

a) $n=1$, $L=2$, $m_L=-1$, $m_s=+1/2$ → not allowed

b) $n=2$, $L=2$, $m_L=0$, $m_s=+1/2$ → not allowed

c) $n=3$, $L=2$, $m_L=-1$, $m_s=-1/2$ → allowed.

d) $n=2$, $L=1$, $m_L=+1$, $m_s=0$ → not allowed, m_s can't be 0, just $+1/2$ or $-1/2$.

e) $n=0$, $L=0$, $m_L=0$, $m_s=+1/2$ → not allowed, there is no $n=0$

always $n > L$

n always larger than L

200. mL of 0.631 M HCl were mixed with 200. mL of 0.631 M NaOH and the enthalpy of the reaction was −55.8 kJ/mol. Given that the density of solution is 1.00 g/mL and its specific heat is 4.07 J/g.°C. Calculate the increase temperature of the reaction solution. (ignore the he absorbed by the calorimeter)

$$HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$

a) 1.58 °C
b) 2.27 °C
c) 2.95 °C
d) 3.64 °C
e) 4.33 °C

$HCl + NaOH \rightarrow NaCl + H_2O$

200ml, 0.631 M : $= 0.126$ mol

200 ml, 0.631 M : $= 0.126$ mol

* same no. of moles → no Limiting reactant

heat of reaction $= -55.8 \frac{KJ}{mol} \times 0.126\,mol = -7.042\,KJ$

$q_{rxn} = -q_{calorimeter}$

$-7.042 = -\,mass \times S \times \Delta t$

mass of solution = 200ml + 200ml = 400ml

density = 1, so 400ml = 400g

$-7.042 = -400\,g \times 4.07 \times 10^{-3} \times \Delta t$

10^{-3} to convert J → KJ because q_{rxn} by KJ

$\Delta t = 4.33\,^{\circ}C$

(e)

Nickel metal is produced via the thermal decomposition of nickel tetracarbonyl:

$$Ni(CO)_{4(l)} \longrightarrow Ni_{(s)} + 4\ CO_{(g)}$$

What is the volume of CO formed from the complete decomposition of 30.0 g of $Ni(CO)_4$ at 1.00 atm and 0°C?

a) 12.6 liters
b) 25.3 liters
c) 31.6 liters
d) 8.63 liters
e) 17.2 liters

$Ni(CO)_4$ is not gas so we can't directly use it mass or moles and use $PV = nRT$.

تذكر $A \rightarrow B$ حادثين مختلفا

* جعل نسبة وتناسب بين $Ni(CO)_{4(l)}$ و $CO_{(g)}$

1 mol $Ni(CO)_4$ ⟶ 4 mol CO

30 g ⟶ x ⟹ $x = 0.703$ mol CO

M.w $Ni(CO)_4$ ← 170.7 g/mol

$$V_{CO} = \frac{n_{CO} \times R \times T_K}{P_{atm}} = \frac{0.703 \times 0.0821 \times 298.15}{1} = 17.2\,L$$ (e)

(25°C)

A mixture of CH_4 and CO_2 were placed in a container with total pressure of 1.5 atm. If the partial pressure of CO_2 is 1.2 atm. Calculate the mole fraction of CH_4.

a) 0.47
b) 0.20
c) 0.35
d) 0.80
e) 0.11

- mole fraction of CH_4 $\quad X_{CH_4} = \dfrac{P_{CH_4}}{P_{total}} = \dfrac{(P_{total} - P_{CO_2})}{P_{total}}$

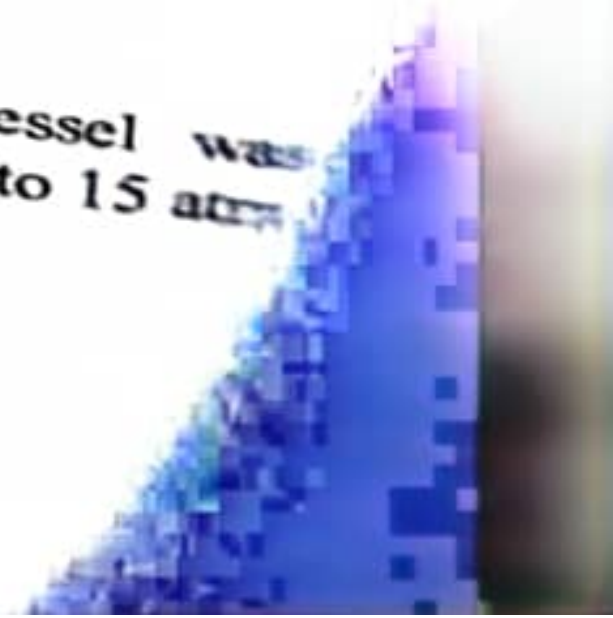
$$= \frac{1.5 - 1.2}{1.5}$$

$$= 0.2$$

(b)

5.0 moles of a gas that occupies 5.0 L vessel was pressurized at constant temperature from 10. atm to 15 atm. The final volume is:

a) 1.3 Liter
b) 2.5 Liter
c) 3.7 Liter
d) 3.3 Liter
e) 4.5 Liter



Boyle's Law $\Rightarrow$ $P_i V_i = P_f V_f$

$$10\,\text{atm} \times 5\,\text{L} = 15\,\text{atm} \times V_f$$

$$V_f = \frac{10 \times 5}{15} = \boxed{3.3\,\text{L}}$$

(d)

Given the following thermochemical equations:

$C_2H_6O_{(l)} + 3\ O_{2(g)} \rightarrow 2\ CO_{2(g)} + 3\ H_2O_{(l)}$ $\Delta H = -710.5$ kJ

$C_2H_4O_{(l)} + 5/2\ O_{2(g)} \rightarrow 2\ CO_{2(g)} + 2\ H_2O_{(l)}$ $\Delta H = -583.5$ kJ

Calculate the $\Delta H°$ for the following reaction (in kJ/mol):

$$2C_2H_4O_{(l)} + 2H_2O_{(l)} \rightarrow 2C_2H_6O_{(l)} + O_{2(g)}$$

a) 204
b) 114
c) 254
d) 107
e) 114

$\Delta H_{①} = -710.5$ $C_2H_6O + 3O_2 \rightarrow 2CO_2 + 3H_2O$ ①

$\Delta H_{②} = -583.5$ $C_2H_4O + \frac{5}{2}O_2 \rightarrow 2CO_2 + 2H_2O$ ②

$\Delta H = ??$ $2C_2H_4O + 2H_2O \rightarrow 2C_2H_6O + O_2$

الحل/ راح نحوّل التفاعلات الي فيهم ΔH معلومة للتفاعل المطلوب
ونراعي التغير الحاصل لـ ΔH.

* C_2H_4O بنلاحظ انه في التفاعل المطلوب مضروبة بـ 2 وموجودة في التفاعلات بنفس المكان الي موجودة فيه في التفاعل المطلوب لذلك بنضربها بـ 2 وبالتالي قيمة الـ ΔH الخاصة فيها حتنضرب بـ 2 كمان.

new ΔH:

$\Delta H_{②} = -583.5 \times 2 = -1167$ KJ

$2C_2H_4O + 5O_2 \rightarrow 4CO_2 + 4H_2O$

* بالنسبة للأكسجين O_2 والـ H_2O عشانهم موجودين في التفاعلين خليهم أخر الشي، ركز بالـ C_2H_6O، ولاحظ انها مضروبة بـ 2 وموجودة في النواتج عكس التفاعل الاول المعطى موجودة في التفاعلات مش مضروبة بـ 2 لذلك نضرب قيمة الـ ΔH بـ 2 ونعكس اشارتها.

new ΔH:

$\Delta H_{①} = +710.5 \times 2 = 1421$ KJ

$4CO_2 + 6H_2O \rightarrow 2C_2H_6O + 6O_2$

$\Delta H_{result} = -1167 + 1421 = 254$ (e)