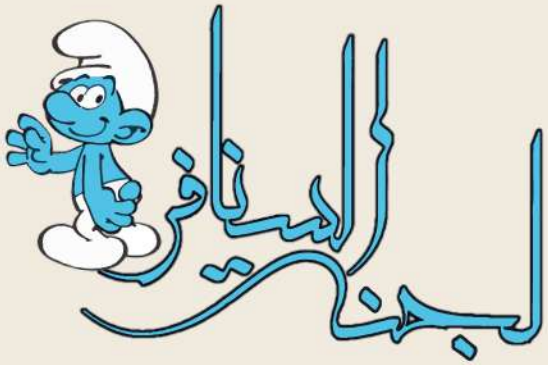
خدمتكم عبادة نتقرب بها الى الله

2021

أسئلة سنوات

ورقي

كيمياء عامة



سنافر البوليتكنك 2021

Faculty of Engineering Technology
Department of Physics and Basic Sciences.
General Chemistry (CHEM 101) Final examination

Name (in Arabic): ---------- **Date: 14/5/2016**
Time 120 minutes **INSTRUCTOR:**

Helpful data: Awt ($gmol^{-1}$) for Na = 23.0, Mg = 24.3, Al = 27.0, Fe = 55.85, Ca = 40.1, O = 16.0, H = 1, N = 14, C = 12.0. $R = 8.314\ J.mol^{-1}.K^{-1}$

$\ln(k_2/k_1) = -E_a/R\,(1/T_2 - 1/T_1)$ where $T_2 > T_1$.

Question No.	1	2	3	4	5	6	7	8	9	10	11	12
Answer												

Question No.	14	15	16	17	18	19	20	21	22	23	24	25
Answer												

Circle the most correct answer in the following questions:

1. Balance the following equation using minimum integral coefficients:

$$NH_3 + O_2 \rightarrow NO_2 + H_2O$$

The stoichiometric coefficient for H_2O is:
(a) 6 (b) 4 (c) 3 (d) 7 (e) 5

2. Which of the following is **correct** about the catalyst?
(a) it increases the energy barrier between reactants and products.
(b) it changes the equilibrium concentration of the products.
(c) it does not affect a reaction energy path.
(d) it always decreases the rate for a reaction.
(e) None of the above

3. Which of the following thermodynamic quantities is a state function?
(a) Gibbs free energy (b) enthalpy (c) entropy (d) internal energy (e) A

4. If $[A]_o$ of a zero order reaction = a, then the time required for 50% conversi
(a) a /2k (b) ak (c) 2k/a (d) k/a (e) a/k

5. The original concentration of a first- order reaction is 0.84 M. What is the
if, after 2.0 minutes, the reactant concentration is 0.062 M?
(a) 4 s (b) 64 s (c) 8 s (d) 32 s (e) 16 s

6. Given: $A + 3B \rightleftharpoons 2C + D$

This reaction is first order with respect to reactant A and first order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____.

(a) increase, 2 (b) decrease, 2 (c) increase, 4 (d) decrease, 4 (e) not change

7. By which factor the rate of a reaction increased upon raising the temperature from 300 K to 360 K, if the activation energy of the reaction is 60 kJ.

(a) 27 (b) 35 (c) 100 (d) 53 (e) 50

8. If the activation energy in the forward direction of a reaction is 74 kJ and the activation energy in the reverse direction is 52 kJ, what is the ΔH value for this reaction?

(a) 22 kJ (b) -22 kJ (c) 52 kJ (d) -52 kJ (e) 126 kJ

9. At a constant temperature, an ideal gas is expanded from 4.0 liters to 6.0 liters against a constant external pressure of 5.0 atm. How much work is done?

(a) $w = +10$ liter atm (b) $w = -10$ liter atm (c) $w = +30$ liter atm

(d) $w = -30$ liter atm (e) The answer cannot be calculated.

10. For which of the following reactions would the ΔH° for the reaction be labeled ΔH_f°?

(a) $PCl_3(g) + 1/2\ O_2(g) \rightleftharpoons POCl_3(g)$

(b) $1/2\ N_2O(g) + 1/4\ O_2(g) \rightleftharpoons NO(g)$

(c) $CaO(s) + SO_2(g) \rightleftharpoons CaSO_3(s)$

(d) $Al(s) + 3/2\ H_2(g) + 3/2\ O_2(g) \rightleftharpoons Al(OH)_3(s)$

(e) The ΔH° for all these reactions would be labeled ΔH_f°.

11. Calculate ΔH° for the reaction:

$$Na_2SO_4(g) \rightleftharpoons Na_2O(s) + SO_3(g)$$

given the following information:

	ΔH°
(1) $Na(s) + H_2O(l) \rightleftharpoons NaOH(s) + 1/2\ H_2(g)$	-146 kJ
(2) $Na_2SO_4(s) + H_2O(l) \rightleftharpoons 2NaOH(s) + SO_3(g)$	+418 kJ
(3) $2Na_2O(s) + 2H_2(g) \rightleftharpoons 4Na(s) + 2H_2O(l)$	+259 kJ

(a) +255 kJ (b) -435 kJ (c) -581 kJ (d) +581 kJ (e) -452 kJ

12. In the ground state of a cobalt $_{28}Ni$ atom there are _____ unpaired electrons and the atom is _____.
(a) 3, paramagnetic (b) 5, paramagnetic (c) 2, diamagnetic
(d) 0, diamagnetic (e) 2, paramagnetic

13. All of the following properties of the alkaline earth metals increase going down the group **except**
(a) atomic radius (b) atomic volume (c) ionic radius
(d) atomic mass (e) none of the above

14. Which of these isoelectronic species has the **largest** radius?
(a) $_{35}Br^-$ (b) $_{38}Sr^{2+}$ (c) $_{37}Rb^+$ (d) $_{34}Se^{2-}$ (e) All have the same size

15. For the reaction, $A + B \rightleftharpoons C$, $\Delta H^\circ = +30$ kJ; $\Delta S^\circ = +50$ J/K.
Therefore the reaction is:
(a) spontaneous at temperatures greater than 600 K.
(b) spontaneous at all temperatures.
(c) nonspontaneous at all temperatures.
(d) spontaneous at temperatures less than 600 K
(e) spontaneous only at 25°C.

16. The ΔH° for the following reaction at 298 K is -36.4 kJ.
$$HBr(g) \rightleftharpoons 1/2\ H_2(g) + 1/2\ Br_2(l)$$
Calculate ΔE° at 298 K. The universal gas constant, R, is 8.314 J/mol K.
(a) -35.2 kJ (b) +35.2 kJ (c) -36.4 kJ (d) -37.6 kJ (e) +37.6 kJ

17. What is the charge on the copper (Cu) ion in, $Cu_3(CO_3)(OH)_?$
(Hint: $MgCO_3$ and $Mg(OH)_2$ are common salts)
(a) 2+ (b) 1+ (c) 0 (d) 1- (e) 2-

18. How many milliliters of 0.200 M NH_4OH are needed to react with 24.0 mL of 0.550 M $FeCl_3$?
$$FeCl_3 + 3NH_4OH \rightarrow Fe(OH)_3 + 3NH_4Cl$$
(a) 99.0 mL (b) 33.0 mL (c) 8.25 mL (d) 68.8 mL (e) 198 mL

19. How many mL of 17 M NH_3 must be diluted to 250.0 mL to make a 0.75 M solution?
(a) 11 mL (b) 22 mL (c) 39 mL (d) 73 mL (e) none of these

20. What are the units of k for the rate law: Rate = $k[A]^2[B]^2$, when the concentration unit is mol/L?
(a) s^{-1} (b) s (c) $L^3\ mol^{-3}\ s^{-1}$ (d) $L^2\ mol^{-2}\ s^{-1}$ (e) $L^2\ s^2\ mol^{-2}$

for this reaction:

$NH_4^+(aq) + NO_2^-(aq) \rightarrow N_2(g) + 2H_2O(l)$

TRIAL	$[NH_4^+]$	$[NO_2^-]$	RATE
1	0.010 M	0.020 M	0.020 M/s
2	0.015 M	0.020 M	0.030 M/s
3	0.010 M	0.010 M	0.005 M/s

The rate law for the reaction is:

(a) Rate = $k[NH_4^+][NO_2^-]$

(b) Rate = $k[NH_4^+]^2[NO_2^-]^2$

(c) Rate = $k[NH_4^+]^2[NO_2^-]$

(d) Rate = $k[NH_4^+][NO_2^-]^3$

(e) none of the above

22. The combustion of ethane (C_2H_6) is represented by the equation:

$$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$$

In this reaction:

(a) ethane is consumed one half as CO_2 is formed.

(b) the rate of formation of CO_2 equals the rate of formation of water.

(c) water is formed at a rate equal to two-thirds the rate of formation of CO_2.

(d) the rate of consumption of oxygen equals the rate of consumption of water.

(e) CO_2 is formed twice as fast as ethane is consumed.

23. A 1.0 g sample of a compound containing only antimony Sb (Awt = 122 g/mol) and oxygen was found to contain 0.836 g of antimony and 0.164 g of oxygen. What is the simplest formula for the compound?

(a) SbO (b) SbO_2 (c) Sb_2O_3 (d) Sb_3O_4 (e) Sb_2O_5

24. Calculate ΔH_{rxn}

$$2FeS_2(s) + 5O_2(g) \rightarrow 2FeO(s) + 4SO_2(g)$$

given the following information:

ΔH_f° for $SO_2(g)$ = -297 kJ/mol

ΔH_f° for FeO(s) = -268 kJ/mol

ΔH_f° for FeS2(s) = -177kJ/mol

(a) -1550 kJ (b) -1370 kJ (c) -774 kJ (d) -686 kJ (e) +808 kJ

25. Estimate the boiling point of $Br_2(l)$ ($\Delta H = 30.9$ kJ; $\Delta S = 93.0$ J/K).

$$Br_2(l) \rightarrow Br_2(g)$$

(a) 59°C (b) 85°C (c) 373°C (d) 177°C (e) 44°C

26. Which element has the higest first ionization energy?

(a) $_2He$ (b) $_{10}Ne$ (c) $_{18}Ar$ (d) $_{36}Kr$ (e) $_{54}Xe$

Good Luck

1) $2NH_3 + \frac{7}{2}O_2 \rightarrow 2NO_2 + 3H_2O$

ans: (c) 3

2) ans: (c) it does not affect a reaction energy path

3) ans: (e) All

4) ans: (a) a/2k

5) $\ln \frac{[A]_t}{[A]_\circ} = -kt$

$\ln \frac{0.062}{0.84} = -k * 120$

$-2.6 = -120k$

$k = 0.02\ s^{-1}$

$t_{1/2} = \frac{\ln 2}{k}$

$= 31.9$

ans: (d) 32 s

بعد حساب السؤال لا تقربوا اتبع على الآلة الحاسبة

6) order of [A] = 1

order of [B] = 2

$rate = k[A][B]$ --- ①

$rate_{②} = k\ 2[A] * \frac{1}{2}[B]$ --- ②

② ÷ ①

$\frac{rate_{②}}{rate} = \frac{k * 2[A] * \frac{1}{2}[B]}{k * [A] * [B]}$

$\frac{rate_{②}}{rate} = 1$

ans: (c) not change

7) $\frac{k_2}{k_1} = ??$

$\ln\left(\frac{k_2}{k_1}\right) = \frac{-Ea}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

$\ln\left(\frac{k_2}{k_1}\right) = \frac{-69 * 10^3\ J}{8.314\ J.mol^{-1}.k^{-1}}\left(\frac{1}{360} - \frac{1}{300}\right)$

$\ln\left(\frac{k_2}{k_1}\right) = 4.6106$

$\frac{k_2}{k_1} = shift + \ln 4.6106 = 100.5$

ans: (c) 100

8) $\Delta H = H_{products} - H_{reactants}$

or $\Delta H = Ea_{reverse} - Ea_{forward}$

$= 52 - 74$

$= -22\ kJ$ (b)

9) $W = -P_{ext} \Delta V$

$= -5 * 2$

$= -10\ L\ atm$

(b)

$\Delta V = V_2 - V_1$

$= 6 - 4$

$= 2\ L$

10) (d) $Al_{(s)} + \frac{3}{2}H_{2(g)} + \frac{3}{2}O_{2(g)} \rightarrow Al(OH)_3$

11) (① * -2) $2NaOH + H_2 \rightarrow 2Na + 2H_2O$ $\Delta H = 292\ kJ$

+

(② * 1) $Na_2SO_4 + H_2O \rightarrow 2NaOH + SO_3$ $\Delta H = 418\ kJ$

+

(③ * $\frac{-1}{2}$) $2Na + H_2O \rightarrow Na_2O + H_2$ $\Delta H = -129.5\ kJ$

$Na_2SO_4 \rightarrow Na_2O + SO_3$ $\Delta H =$

$292 + 418 - 129.5$

$= 580.5\ kJ$

(d)

12) $Ni_{28}: 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$

$\uparrow\downarrow\ \uparrow\downarrow\ \uparrow\downarrow\ \uparrow\ \uparrow$

unpaired e's

ans: (e) 2, paramagnetic

13) ans: (e) none of above

14) $Br_{35}^-: [Ar_{18}]\ 4s^2\ 3d^{10}\ 4p^6$

$Sr_{38}^{+2}: [Ar_{18}]\ 4s^2\ 3d^{10}\ 4p^6$

$Rb_{37}^+: [Ar_{18}]\ 4s^2\ 3d^{10}\ 4p^6$

$Se_{34}^{-2}: [Ar_{18}]\ 4s^2\ 3d^{10}\ 4p^6$

All have the same n and Z

ans: (e) All have the same size

15 $T_{eq} = \frac{\Delta H}{\Delta S} = \frac{30}{0.05} = 600$ kelvin

ans: (a) spontaneous at temperatures greater than 600 k

16 $\Delta E = \Delta H - \Delta n_g TR$

$= -36400 - (-0.5) * 298 * 8.314$

$= -35161$ J

$= -35.161$ kJ

$\Delta n_g = \frac{1}{2} - 1 = -\frac{1}{2}$

ans: (a) -35.2 kJ

17 $3Cu + (CO_3)^{-2} + (OH)^-$

$3x + -2 + -1 = 0$

$3x = 3$

$x = +1$ (b)

12 $\frac{1}{3}$ Moles (NH_4OH) = Moles $FeCl_3$

$\frac{1}{3} M V_{(NH_4OH)} = M V_{(FeCl_3)}$

$\frac{1}{3} * 0.2 V = 0.55 * 24$

$V = 198$ ml (e)

19 (Dilution)

$M_1 V_1 = M_2 V_2$

$\frac{17}{17} V_1 = \frac{0.75 * 250}{17}$

$V_1 = 11$ ml (a)

20 $k = M^{1-x} \cdot s^{-1}$ $x = 4$

$= \frac{mol^{1-x}}{L^{1-x}} \cdot s^{-1}$

$= \frac{mol^{-3}}{L^{-3}} \cdot s^{-1}$

$= L^3 mol^{-3} \cdot s^{-1}$ (c)

21 $\left[\frac{0.015}{0.010}\right]^n = \frac{0.80}{0.020}$

n = order of NH_4^+

ms = NO_2

$[1.5]^n = 1.5$

$n = 1$

$\left[\frac{0.020}{0.010}\right]^m = \frac{0.020}{0.005}$

$[2]^m = 4$

$m = 2$

rate $= k [NH_4^+] [NO_2]^2$

ans: (e) none of the above

22 $\frac{1}{2}$ rate $C_2H_6 = \frac{1}{7}$ rate $O_2 = \frac{1}{4}$ rate $CO_2 = \frac{1}{6}$ rate H_2O

ans: (a) ethan is consumed one half as CO_2 is formed

$\left(2x \frac{1}{2} \text{ rate } C_2H_6 = \frac{1}{4} \text{ rate } CO_2 \times 2 \right.$

$\left. \text{rate } C_2H_6 = \frac{1}{2} \text{ rate } CO_2 \right)$

23 moles $Sb = \frac{0.836}{122} = \frac{0.0068}{0.0068}$

moles $O_2 = \frac{0.164}{16} = \frac{0.0102}{0.0068}$

Sb : 1

O_2 : 1.5 ≃ 2

1 : 2

Sb : O

SbO_2 (b)

24 $\Delta H = \Sigma H°f_{products} - \Sigma H°f_{reactants}$

$= [2 * -268 + 4 * -297] - [2 * -177 + 0]$

$= -1724 - 354$

$= -1370$ kJ (b)

25 Boiling point = $T_{eq} = \frac{\Delta H}{\Delta S}$

$= \frac{30900}{393}$

$= 332.25\ k$

$= 54.2°C$

ans: (a)

26 ans: (c)

لأنه الباقي

Nobel gases

96500 C/mole e⁻

Transfer your answer to the table below in CAPITAL LETTERS

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer					D	E	C						

Question	14	15	16	17	18	19	20	21	22	23	24	25
Answer									E		E	E

Choose the most correct answer for each of the following questions:

1. Consider the unbalanced redox equation:
$\_CH_3OH_{(l)} + \_Cr_2O_7^{2-}{}_{(aq)} + \_H^+{}_{(aq)} \rightarrow \_\_CH_2O_{(aq)} + \_Cr^{3+}{}_{(aq)} + \_\_H_2O_{(l)}$. Which of the following sets of numbers will balance the equation?

A) 3, 1, 8, 3, 2, 7 B) 1, 3, 8, 3, 2, 4 C) 8, 1, 3, 4, 3, 2 D) 3, 8, 1, 2, 3, 7
E) 3, 1, 8, 3, 2, 4

2. In which of the following does sulfur have an oxidation number of +7?

A) H_2SO_3 B) $H_2S_2O_3$ C) H_2SO_4 D) $H_2S_2O_8$ E) S_2F_{10}

3. Examine the data on the right. The strongest oxidizing agent among these substances is:

A) Sr^{2+} B) Cr^{2+} C) Co^{2+}
D) Zn^{2+} E) Fe^{2+}

half-reduction reactions	E° (V)
$Sr^{2+} + 2e^- \rightarrow Sr$	-2.89
$Cr^{2+} + 2e^- \rightarrow Cr$	-0.913
$Fe^{2+} + 2e^- \rightarrow Fe$	-0.447
$Co^{2+} + 2e^- \rightarrow Co$	-0.280
$Zn^{2+} + 2e^- \rightarrow Zn$	-0.760

4. The mass (in g) of Cu (63.55 g/mol) that can be deposited by the passage of 12.0 A for 25.0 min through $CuSO_{4(aq)}$ solution equals:

A) 5.93 B) 16.59 C) 6.91 D) 19.36 E) 14.38

5. A flask containing 0.124 mol of A and was allowed to react according to the equation $A_{(g)} \rightarrow B_{(g)}$, the data on the right were obtained for moles of A as the reaction proceeded, The avera rate of disappearance of A between 10 and 20 seconds equals:

Time (s)	0.00	10.0	20.0	30.0	40
Moles of A	0.124	0.110	0.088	0.073	0.0

A) 1.9×10^{-3} B) 2.2×10^{-3} C) 3.1×10^{-3} D) 1.75×10^{-3}
E) 1.50×10^{-3}

In $[N_2O_5]$ and the time, and Δ Ln$[N_2O_5]$ was - 1.16 during a time period of 2030 s. The value of the rate constant k equals:

A) 7.25×10^{-4} B) 8.29×10^{-4} C) 7.73×10^{-4} D) 6.44×10^{-4} E) 5.71×10^{-4}

7. During the experimental determination of the rate law for the reaction $A + B \rightarrow P$, it was found that the rate increased by a factor of 9 when the concentration of B was tripled, this reaction is ----------order in B

A) Zero B) first C) second D) third E) forth

1. Determine the rate law expression for the reaction $2A + B_2 + C \rightarrow A_2B + BC$, using the kinetic data provided on the table:

Run	$[A]_o$	$[B_2]_o$	$[C]_o$	Initial rate (M/s)
1	1.2	1.0×10^{-2}	1.0	1.6×10^{4}
2	2.4	1.0×10^{-2}	1.0	1.6×10^{4}
3	1.2	2.0×10^{-2}	1.0	3.2×10^{8}
4	1.2	1.0×10^{-2}	2.0	6.4×10^{4}

A) $R = k[A][C]^2$ B) $R = k[A][B_2]^2$
C) $R = k[B_2]^2[C]^2$ D) $R = [A]^2[B_2]^2$
E) $R = k[B_2][C]^2$

. The rate constant k for the reaction $CH_3N{\equiv}C \rightarrow CH_3C{\equiv}N$ equals $6.29 \times 10^{-4}\ s^{-1}$, if the $[CH_3N{\equiv}C]_o$ is 1.00×10^{-3} M, then its concentration after 3.5×10^{3} s equals:

A) 3.89×10^{-4} B. 1.11×10^{-4} C. 2.84×10^{-4} D. 2.08×10^{-4} E. 5.33×10^{-4}

0. For the second order reaction A → products, 25 % of A were found to be consumed in 60.0. What is the second half life (in hr) when the initial concentration of A equals 1.0 M?

A) 466.2 B) 371.7 C) 600.6 D) 800.0 E) 1136.4

1. The rate constant for the reaction A→ B is 0.039 $M^{-1}s^{-1}$. The final concentration of A after 45 s was 0.30 M, its initial concentration equals:

A) 0.410 B) 0.463 C) 0.392 D) 0.480 E) 0.633

2. The rate constant k for a certain reaction was $3.7 \times 10^{-3}\ s^{-1}$ at 25 °C. If the activation energy for this reaction was 43.6 kJ/mol, then the value of rate constant for this reaction at 75 °C equals:

A) 5.7×10^{-2} B) 4.6×10^{-2} C) 3.7×10^{-2} D) 2.4×10^{-2} E) 4.9×10^{-3}

3. The rate equation for the reaction: A → B is $R = k[A]^0$. If the initial concentration of the reactant [A] is 1.0 mol L^{-}, the half-life period of the reaction is:

A. k/[A] B. [A]/k C. 2[A]/k D) [A]/2k E) 2k/[A]

4. Carefully inspect the profile on the right for the reaction $C_2H_5Cl \rightarrow C_2H_4 + HCl$; what is the activation energy of the REVERSE reaction, and is the FORWARD reaction exothermic or endothermic?

B) 205 kJ and exothermic reverse reaction
C) 210 kJ and endothermic forward reaction
D) 200 kJ and exothermic reverse reaction
E) 205 kJ and endothermic forward reaction

15. Which one of the following statement is **INCORRECT** concerning a catalyst?
A) A homogeneous catalyst is in the same phase as compared to the reactants.
B) A heterogeneous catalyst is in a different phase as compared to the reactants.
C) A catalyst enhances the rate by decreasing the Ea of the reaction.
D) A catalyst is consumed during the reaction.
E) A catalyst is chemically unchanged.

16. For the reaction $CO_{2(s)} \rightleftharpoons CO_{2(g)}$, if the standard enthalpy of sublimation equals 26.2 kJ/Mol, then the standard entropy of sublimation (in $J.mol^{-1}$) equals:
A) 87.9 B) 233.0 C) 94.6 D) 209.5 E) 81.2

17. Use the data provided on the right to find ΔH for the combustion of 14.4 g of phenol (C_6H_5OH, 94.11 g/mol)
A) - 467.2 B) - 824.0 C) - 438.0 D) - 561.3 E) - 496.4

	$C_6H_5OH_{(s)}$	$+7O_{2(g)} \rightarrow$	$6CO_{2(g)} +$	$3H_2O_{(l)}$
$\Delta H°_f$ (kJ/mol)	- 165.0		- 393.5	- 285.8

18. Use the data provided in the table below to find ΔH (kJ/mol) for the reaction: $N \equiv N + 3\ H\text{-}H \rightarrow 2NH_3$
A) -78 B) 75 C) -109 D) 79 E) -75

Bond	BE (kJ/mol)
N≡N	+ 945
H-H	+ 436
N-H	+ 388

9. Which one of the following reactions has a **POSITIVE** entropy change?
A) $BF_{3(g)} + NH_{3(g)} \rightarrow F_3BNH_{3(s)}$
B) $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$
C) $H_2O_{(g)} \rightarrow H_2O_{(l)}$
D) $2NH_4NO_{3(s)} \rightarrow 2N_{2(g)} + 4H_2O_{(g)} + O_{2(g)}$
E) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

For the reaction $2CO_{(g)} + 2H_{2(g)} \rightarrow CO_{2(g)} + CH_{4(g)}$, if $\Delta H° = -247.3$ kJ/mol and $\Delta S° = -256.5$ J/mol K the value of $\Delta G°$ for the reaction:
A) - 170.9 B) 175.6 C) 160.9 D) 181.6 E) 170.9

A solution was prepared by dissolving 50.0 mL of $CHCl_3$ in enough amount of acetone to produce 100 L solution. If the density of $CHCl_3$ was 1.486 g/mL, the molar concentration of this solution equals:
A) 3.73×10^{-3} B) 6.21×10^{-5} C) 7.46×10^{-3} D) 5.60×10^{-3}
E) 8.70×10^{-3}

22. How many nitrogen atoms are in 125.00 g $NH_4H_2PO_4$ (molar mass 114 g/mol)?

A) 2.64×10^{24} B) 3.96×10^{24} C) 4.28×10^{24} D) 2.85×10^{24} E) 6.60×10^{2}

3. Consider the equation: $Ba(OH)_{2(aq)} + H_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2H_2O_{(l)}$. If 380.0 mL 0.273 M $Ba(OH)_{2(aq)}$ solution were mixed with 500.0 mL of 0.520 M $H_2SO_{4(aq)}$, 20 g $BaSO_{4(s)}$ (233.4 g/mol) were obtained, the % yield of reaction equals:

A) 67.07 % B) 62.93 % C) 83.60 % D) 75.33 E) 87.73 %

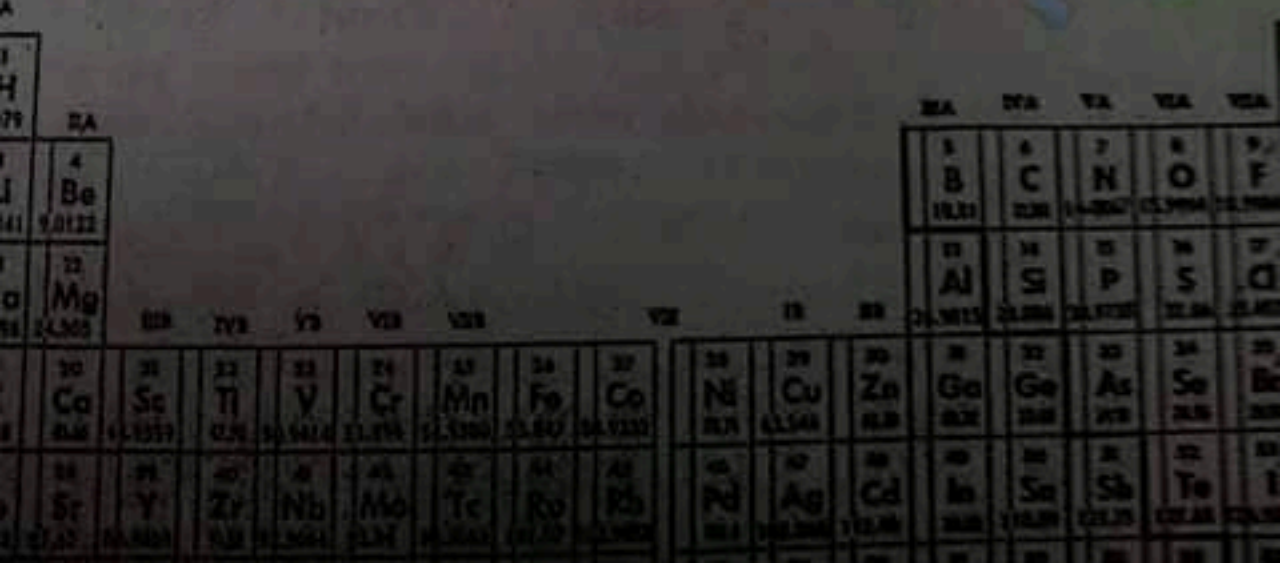
. Choose the correct set of transition elements:

A) B, Ge, Te, Po B) Yb, Sm, Eu, Dy C) Pa, Np, Am, No

D) P, S, Cl, Br E) Sc, Zr, Cd, Os

The correct set of quantum numbers (n, l, m_l, m_s) for the second electron orbital is:

A) 4, 2, -2, $\frac{1}{2}$ B) 4, 2, 0, $\frac{1}{2}$ C) 4, 1, 0, $\frac{1}{2}$ D) 4, 1, 1, $\frac{1}{2}$ E) 4, 2, -1,



1- Which one of the following reactions represents the energy change associated with the 2nd electron affinity?

a) $O_{(g)} + 1e^- \rightarrow O^-_{(g)}$ b) $O^-_{(g)} + 1e^- \rightarrow O^{2-}_{(g)}$ c) $Na_{(g)} \rightarrow Na^+_{(g)} + e^-$

d) $Na^+_{(g)} + e^- \rightarrow Na_{(g)}$ e) $K_{(g)} - 1e^- \rightarrow K^+_{(g)}$

2- The electron configuration of indium In is:

a) [Kr] $5s^24d^{10}5p^1$ b) [Kr] $5s^24d^{10}5p^2$ c) [Kr] $5s^24d^{10}5p^3$ d) [Kr]$5s^24d^{10}$

e) [Kr] $5s^24d^{10}5p^4$

3- Based on what you've learned about quantum numbers, which of the following sets of quantum numbers for n, l, m_l, and m_s is not possible?

a) 3, 1, -1, - ½ b) 3, 2, 2, 0 c) 4, 3, 2, + ½ d) 4, 3, -2, - ½ e) 5, 3, 2, + ½

4- The molar concentration of 98 % by mass H_2SO_4 solution whose density is 1.84 g/mL equals:

a) 16.9 b) 16.0 c) 18.4 d) 17.8 e) 15.0

5- The % yield for the reaction: $Ba(NO_3)_{2(aq)} + Na_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2NaNO_{3(aq)}$ equals 80 %. If you want to prepare exactly 46.6 g of $BaSO_4$ (233 g/mol), the volume (in mL) of 2M $Ba(NO_3)_{2(aq)}$ solution needed to react with excess $Na_2SO_{4(aq)}$ solution equals:

a) 172 b) 111 c) 166 d) 125 e) 143

6- If 4.2 mol of Al was mixed with 1.0 mol of $Fe_2O_{3(s)}$ to react according to the equation $2Al_{(s)} + Fe_2O_{3(s)} \rightarrow Al_2O_{3(s)} + 2Fe_{(s)}$, the mass (in g) of Al that remains after the reaction equals:

a) 10.8 b) 86.4 c) 32.4 d) 8.3 e) 59.4

7- The molarity (M) of 31.0 g of NaCl (58.5 g/mol) in 300 mL solution equals:

a) 1.77 b) 1.32 c) 0.706 d) 1.06 e) 0.883

8- Consider the following chemical equation: $Mg_3B_2 + 6H_2O \rightarrow 3Mg(OH)_2 + B_2H_6$. If 28.5 g of Mg_3B_2 (93.6 g/mol) was mixed with 28.5 g of H_2O (18 g/mol), the mass (in g) of B_2H_6 (27.6 g/mol) produced equals:

a) 8.40 b) 7.28 c) 11.35 d) 4.72 e) 9.84

9- The number of Ba atoms in 0.02 mol of $Ba_3(PO_4)_2$ equals:

a) 4.82×10^{22} b) 1.20×10^{22} c) 9.64×10^{22} d) 3.61×10^{23} e) 2.41×10^{22}

10- An organic compound was found to be 40.00 % C, 6.67 % H and 53.33 % O, the empirical formula for this compound is:

a) C_2H_4O b) CHO_2 c) CH_2O d) CH_2O_3 e) CH_3O

11- Find ΔH°_{rxn} for the reaction $SO_{3(g)} + CO_{(g)} \rightarrow CO_{2(g)} + SO_{2(g)}$ using the following data:

a) + 184 b) - 184 c) + 552 d) + 92 e) - 368

Substance	$CO_{(g)}$	$SO_{3(g)}$	$SO_{2(g)}$	$CO_{2(g)}$
ΔH°_f(kJ/mol)	- 110.5	- 395.8	- 296.8	- 393.5

12- Which one of the following reactions has a positive entropy change?

a) $H_2O_{(g)} \rightarrow H_2O_{(l)}$ b) $BF_{3(g)} + NH_{3(g)} \rightarrow F_3BNH_{3(s)}$ c) $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

d) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ e) $2NH_4NO_{3(s)} \rightarrow 2N_{2(g)} + 4H_2O_{(g)} + O_{2(g)}$

13- For the reaction: $SiH_{4(g)} + 2O_{2(g)} \rightarrow SiO_{2(s)} + 2H_2O_{(g)}$, use the following data to find the value of ΔS°_{rxn} (in J/K) for this reaction

a) - 432.74 b) - 865.48 c) + 216.37 d) - 216.37 e) + 432.74

Substance	$SiH_{4(g)}$	$O_{2(g)}$	$SiO_{2(s)}$	$H_2O_{(g)}$
S°(J/K.mol)	204.5	205.0	41.84	69.96

14- Calculate ΔG°_f of $PbCl_2$

$PbS_{(s)}$ + 4 $Cl_{2(g)}$ → $PbCl_2$ + $SCl_{2(g)}$ + 59.96 kJ

ΔG°_f (kJ/mol)	- 96.1			
a) - 16.0	b) - 47.6			c) - 52.3

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15- For a particular chemical reaction, ΔH° = 5.5 kJ and ΔS° = - 25 J/K, under what conditions is this reaction spontaneous?

a) when T < 220 K b) when T > 220 K c) the reaction is spontaneous at all T values

d) the reaction is non-spontaneous at any T value e) when T > - 220

The decomposition of $N_2O_{5(g)} \rightarrow NO_{2(g)} + NO_{3(g)}$ proceeds as a first order reaction with a $t_{\frac{1}{2}}$ of [illegible] at a certain temperature. If the initial concentration $[N_2O_5]_0$ = 0.400 M, the

13- For the reaction: $SiH_{4(g)} + 2O_{2(g)} \rightarrow SiO_{2(s)} + 2H_2O_{(l)}$, use the following data to find the value of $\Delta S°_{rxn}$ (in J/K) for this reaction

a) – 432.74 b) – 865.48

c) + 216.37 d) – 216.37 e) + 432.74

Substance	$SiH_{4(g)}$	$O_{2(g)}$	$SiO_{2(s)}$	$H_2O_{(l)}$
$S°_f$ (J/K.mol)	204.5	205.0	41.84	69.96

14- Calculate $\Delta G_f°$ of $PbCl_{2(s)}$ (in kJ/mol) from the following information.

$PbS_{(s)} + 2HCl_{(g)} \rightarrow PbCl_{2(s)} + H_2S_{(g)}$ $\Delta G_{rxn}° = -59.96$ kJ

	$PbS_{(s)}$	$HCl_{(g)}$	$PbCl_{2(s)}$	$H_2S_{(g)}$
$\Delta G_f°$ (kJ/mol)	-96.87	-95.30	?	-33.33

a) – 16.0 b) -47.6 c) – 314.1 d) – 36.2 e) – 52.3

15- For a particular chemical reaction, $\Delta H° = 5.5$ kJ and $\Delta S° = -25$ J/K, under what conditions is this reaction spontaneous?

a) When T < 220 K b) when T > 220 K c) the reaction is spontaneous at all T values

d) the reaction is non-spontaneous at any T value e) when T > - 220

16- The decomposition of $N_2O_{5(g)} \rightarrow NO_{2(g)} + NO_{3(g)}$ proceeds as a first order reaction with a $t_{\frac{1}{2}}$ of 30.0 s at a certain temperature. If the initial concentration $[N_2O_5]_o = 0.400$ M, the concentration of N_2O_5 after 120 s equals:

a) 0.0563 M b) 0.1000 M c) 0.0375 d) 0.0198 M e) 0.025 M

17- For the reaction $2NO + O_2 \rightarrow 2NO_2$, rate = $K[NO]^2[O_2]$ and $K = 7.1 \times 10^8\ M^{-2}s^{-1}$ at 25 °C. The rate of reaction when $[NO]_o = 0.00010$ mol/L and $[O_2]_o = 0.0034$ mol/L equals:

a) 0.241 b) 0.111 c) 0.564 d) 0.353 e) 0.279

18- The following data were collected for the reaction $A + B \rightarrow C$, the rate law for this reaction is:

a) rate = $K[A]\ [B]^2$

b) rate = $K[A]\ [B]$

c) rate = $K[A]$

d) rate = $K[A]^2[B]$

e) rate = $K[A]^2[B]^2$

Initial concentrations (M)		Rate of C formation in $M.s^{-1}$
$[A]_o$	$[B]_o$	
1.7×10^{-3}	1.7×10^{-3}	1.75×10^{-4}
3.4×10^{-3}	1.7×10^{-3}	3.5×10^{-4}
1.7×10^{-3}	3.4×10^{-3}	3.5×10^{-4}

19- The $t_{\frac{1}{2}}$ value for the second order reaction $A \rightarrow$ products, equals 45.6 s. If the initial concentration of A is 0.200 M, the rate constant (in $M^{-1}s^{-1}$) equals:

a) 7.3×10^{-2} b) 2.2×10^{-1} c) 1.10×10^{-1} d) 5.5×10^{-3} e) 1.46×10^{-1}

20- The value of the rate constant for the reaction $aA \rightarrow$ products, $K = 0.225\ M^{-1}s^{-1}$. The time required (in min) for the concentration of A to drop from 0.159 M to 6.07×10^{-3} mol/L equals:

a) 11.74 b) 104.45 c) 11.92 d) 10.02 e) 121.60

21- For the reaction: $CH_3NC \rightarrow CH_3CN$, $K = 6.3 \times 10^{-4}\ s^{-1}$, how long will it take (in s) for 50 % of CH_3NC be consumed?

a) 457 b) 684 c) 1100 d) 1666 e) 258

22- In a first order reaction, what fraction of material will remain after the passage of 2 consecutive half lives?

a) 1/8 b) 1/4 c) 1/32 d) 1/64 e) 1/16

23- The reaction $bB \rightarrow$ products, has a rate constant $K = 0.169\ M^{-1}.s^{-1}$. If the initial concentration of B = 0.50 M, then the first half life for this reaction (in s) equals:

a) 189.6 b) 23.7 c) 47.3 d) 94.8 e) 11.83

24- Given the following:

$4NO_{2(g)} \rightarrow 2N_2O_{(g)} + O_{2(g)}$ $\Delta G° = -139.56$ kJ

$2NO_{2(g)} + O_{2(g)} \rightarrow 2NO_{3(g)}$ $\Delta G° = -69.70$ kJ

The value of $\Delta G°$ for the reaction $2N_2O_{(g)} + 3O_{2(g)} \rightarrow 4NO_{3(g)}$ equals

a) – 0.32 b) – 0.16 c) + 0.16 d) + 0. 08 e) + 0.32

25- A catalyst increases the rate of the chemical reaction by :

a) Providing an alternative pathway with a lower value of E_a

b) Providing an alternative pathway with a higher value of E_a

c) Changing the products formed in the reaction

d) Changing $\Delta H°$ enthalpy of reaction

AL-BALQA APPLED UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY
GENERAL CHEMISTRY (CHEM 101) FINAL EXAMINATION

Student name (in Arabic): —

DATE: 21/5/2019
TIME: 120 minutes

Instructor: ——

Registration No: ——————————

Time of lecture: 10 am

Helpful data:

Avogadro's number: 6.022×10^{23} objects / mol; $R = 8.314\ J \cdot mol^{-1} \cdot K^{-1}$; specific heat $H_2O = 4.184\ J \cdot g^{-1} \cdot °C^{-1}$; $\ln(k_1/k_2) = -E_a / R\,(1/T_1 - 1/T_2)$ where $T1 > T_2$; $(1\ L \cdot atm) = 101.325\ J$

- Choose the most correct answer for each of the following questions and transfer all your answers to the table below in capital letters

ANSWER SHEET

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer													

Question	14	15	16	17	18	19	20	21	22	23	24	25
Answer												

1. The oxidation No Of Cl in ClO^- is:
   A) +3 B) +1 C) +6 D) +7 E) +5

2. Consider the equation: $\_\_ClO_3^- + \_\_H^+ + \_\_Cu \rightarrow \_\_Cu^{2+} + \_\_Cl^- + \_\_H_2O$, the correct arrangement of coefficient in the balanced equation equals:
   A) 1, 6, 2, 1, 2, 3 B) 6, 2, 1, 1, 2, 3 C) 1, 2, 6, 1, 2, 3
   D) 1, 2, 6, 2, 1,3 E) 1, 6, 2, 2, 1, 3

3. Consider the data collected for the reaction A → B, the rate of A consumption between 10 and 20 minutes equals:

Time (min)	0	10	20	30	40
Moles of A	0.065	0.051	0.042	0.036	0.031

   A) 9.0×10^{-4} B) 7.5×10^{-4} C) 6.0×10^{-4} D) 5.5×10^{-4} E) 8.5×10^{-4}

4. Consider the reaction $C_3H_{8(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(g)}$, if the concentration of $O_{2(g)}$ is decreasing at a rate of 1.11 M/s, then $C_3H_{8(g)}$ concentration is decreasing at a rate of:
   A) 0.74 B) 1.11 C) 0.247 D) 0.123 E) 0.37

5. The reaction A + B → C has the rate law Rate = $k[B]^2$, if the concentration of B is doubled, then the rate of reaction will:
   A) increase by a factor of 4 B) be doubled C) increase by a factor of 9
   D) increase by a factor of 8 E) not change

6. The data on the right were collected for the reaction A + B → Products, the rate law for this reaction is:

[A]	[B]	Rate, M/s
1.5×10^{-3}	1.5×10^{-3}	1.36×10^{-4}
3.0×10^{-3}	1.5×10^{-3}	2.72×10^{-4}
1.5×10^{-3}	3.0×10^{-3}	1.36×10^{-4}

   A) $R = k[A][B]$ B) $R = k$ C) $R = k[A][B]$ D) $R = k[A]$ E) $R = k[B]$

7. The rate constant for the decay of radioactive Am-241 is 1.6×10^{-3} year^{-1}. The fraction remaining of this isotope after 866 years equals:
A) 1/2 B) 1/16 C) 1/8 D) 1/32 E) 1/4

8. The rate constant for the reaction A → Products is 4.5×10^{-2} M^{-1} s^{-1}. If the initial concentration of A is 0.32 M, the time (in minutes) needed for the reaction of A to become 0.032 M equals:
A) 14.63 B) 10.41 C) 10.09 D) 13.66 E) 5.97

9. The reaction $2NoCl \rightarrow 2\,NO + Cl_2$ has $k = 9.3 \times 10^{-5}$ L. mol^{-1}. s^{-1} at 100 °C, and an activation energy of 99.0 kJ/mol, the value of the rate constant at 130 °C equals:
A) 4.05×10^{-3} B) 4.72×10^{-4} C) 4.61×10^{-2} D) 1.0×10^{-4}
E) 1.44×10^{-3}

10. The reaction $2AB \rightarrow 2A_2 + B_2$ is zero order. Which of the following yield a linear plot?
A) $[AB]^2$ vs time B) 1/[AB] vs time C) [AB] vs time D) ln [AB] vs time
E) $[A_2]$ vs time

11. The catalyzed reaction has a ____ activation energy and thus causes a ____ reaction rate.
A) lower, higher B) higher, higher C) higher, constant D) higher, lower
E) lower, constant

12. Which one of the following reactions has zero entropy change?
A) $H_2O_{(g)} \rightarrow H_2O_{(l)}$ B) $2SO_{3(g)} \rightarrow 2SO_{2(g)} + O_{2(g)}$ C) $CaO_{(s)} + CO_{2(g)} \rightarrow CaCO_{3(s)}$
D) $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$ E) $HCl_{(g)} + NH_{3(g)} \rightarrow NH_4Cl_{(s)}$

13. For the reaction: The change in enthalpy ($\Delta H°_{rxn}$) associated with the combustion of one mole $C_2H_{2(g)}$ equals (in kJ):

	$C_2H_{2(g)}$ +	$5/2O_{2(g)}$ →	$2CO_{2(g)}$ +	$H_2O_{(g)}$
$\Delta H_f°$ (kJ/mol)	227		-393	-242

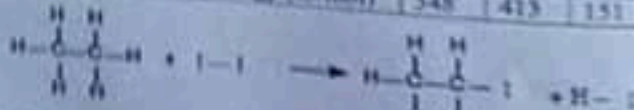
A) - 1323 B) - 1255 C) - 1427 D) - 1277 E) - 1254

14. For the exothermic combustion of hydrogen according to the equation: $2H_{2(g)} + O_{2(g)} \rightarrow H_2O_{(g)}$ the correct statement concerning the spontaneity of this reaction is:
A) Spontaneous at higher temperature because ΔS_{rxn} is positive.
B) Spontaneous at lower temperature because ΔS_{rxn} is positive.
C) Always spontaneous because ΔS_{rxn} is positive.
D) Spontaneous at lower temperature because ΔS_{rxn} is negative.
E) Always spontaneous because ΔS_{rxn} is negative.

15. For a certain reaction, if $\Delta H° = -58.5$ kJ and $\Delta S° = -53.4$ J/K, then $\Delta G°$ for this reaction equals:
A) - 33.643 B) - 65.967 C) - 42.587 D) - 9.921 E) - 74.955

16. Use the data on the right to find ΔH for the reaction below

Bond	C-C	C-H	I-I	C-I	H-I
Bond Energy (kJ/mol)	348	413	151	240	299



A) 164 B) - 36 C) 36 D) - 164 E) 25

17. The best statement that describes the third law of thermodynamics
A) The entropy of a pure and perfectly crystalline matter equals zero at 273.15 K.
B) The entropy of a pure and perfectly crystalline matter equals zero at − 273.15 °C.
C) The entropy of a pure and perfectly crystalline matter equals zero at 25 °C.
D) The entropy of a pure and perfectly crystalline matter equals zero at 298 K.
E) The entropy of a pure and perfectly crystalline matter equals zero at zero °C.

18. How many moles of sulfur (S) are there in 25.6 g of Fe_2S (144 g/mol)?
A) 0.399 B) 0.283 C) 0.240 D) 0.328 E) 0.178

19. Consider the reaction: $2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$, when 0.500 mol of $Al(OH)_3$ and 0.500 mol of H_2SO_4 are allowed to react, then the moles of $Al_2(SO_4)_3$ produced equals
A) 0.233 B) 0.167 C) 0.309 D) 0.250 E) 0.267

20. For the reaction: $6Li + N_2 \rightarrow 2Li_3N$, if 2.5 g of N_2 reacted with enough amount of Li, and the reaction yield was 85.5%, then the grams of Li_3N (49 g/mol) obtained experimentally equals
A) 21.68 B) 12.39 C) 7.74 D) 9.29 E) 15.49

21. The solution that contains the highest concentration of Na^+ ions is:
A) 0.100 M NaH_2PO_4 B) 0.10 M Na_2HPO_4 C) 0.100 M Na_2SO_4
D) 0.100 M Na_3PO_4 E) 0.100 M NaI

22. Which one of the following elements is a nonmetal?
A) Pa B) Sb C) Se D) Ag E) Ho

23. The electron configuration of palladium Pd is:
A) $[Kr]\ 5s^2 4d^{10} 5p^2$ B) $[Kr]\ 5s^2 4d^{10} 5p^2$ C) $[Kr]\ 5s^2 4d^{10} 5p^2$
D) $[Kr] 5s^2 4d^{10}$ E) $[Kr]\ 5s^2 4d^8$

24. Based on what you've learned about quantum numbers, which of the following sets of quantum numbers for n, l, m_l, and m_s is not possible?
A) 3, 1, -1, ½ B) 3, 2, 2, - ½ C) 4, 3, 2, 0 D) 4, 3, -2, - ½
E) 5, 3, 2, ½

25. Choose the most correct answer:
A) Ionization energy of elements decreases in the period from left to right.
B) Electron affinity of elements increases in the period from left to right.
C) Atomic size of elements increases in the period from left to right.
D) Effective nuclear charge decreases in the period from left to right.
E) Ionization energy increases in the group form the top to the bottom.

Al-Balqa Applied University – Faculty of Engineering Technology
Department of Physics and Basic Sciences
General Chemistry 101 Final Examination

Student Name (in Arabic): _____ Time: 2 hours/ 1st Semester; January - 2016
Lecture Date and Time: _____ Instructor name: _____

Helpful data: $N_A = 6.02 \times 10^{23}$ species/mol; $R = 8.314$ J mol^{-1}K^{-1}; $F = 96500$ C/mole e$^-$.

$\ln\frac{k_1}{k_2} = \frac{-E_a}{a}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$; where $T_1 > T_2$

Choose the most correct answer for each of the following questions and transfer it to the table below in CAPITAL LETTERS

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer													

Question	14	15	16	17	18	19	20	21	22	23	24	25
Answer												

1. Consider the unbalanced redox equation:
$\_H_2O + \_CoCl_2 + \_OCl^-_{(aq)} \rightarrow \_Co(OH)_3 + \_Cl^-_{(g)} + \_H^+_{(g)}$. Which of the following sets of numbers will balance the equation?
A) 5, 2, 1, 2, 5, 4 B) 2, 1, 5, 2, 5, 4 C) 5, 1, 2, 2, 5, 4 D) 2, 1, 5, 5, 2, 4
E) 2, 1, 5, 4, 5, 2

2. Electrons are lost by the:
A) Reducing agent as it undergoes reduction
B) Oxidizing agent as it undergoes reduction
C) Reducing agents as it undergoes oxidation
D) Oxidizing agent as it undergoes oxidation
E) Oxidizing agent as it undergoes hydrolysis

3. The oxidation number of Molybdenum (Mo) equals +2 in:
A) MoO_4^{2-} B) Mo_2S_3 C) $MoCl_5$ D) Mo_6Cl_{12} E) MoF_4

4. The mass (in g) of Cr (52.00 g/mol) that can be electroplated by the passage of 5.2 Amperes through a solution of $Cr_2(SO_4)_3$ for 45.0 minutes equals:
A) 3.61 B) 2.522 C) 3.98 D) 3.007 E) 4.62

5. Consider the balanced equation: $2I_2 + S_2O_3^{2-} + 3H_2O \rightarrow 4\ I^-_{(aq)} + 2H_2SO_3 + 2H^+_{(aq)}$. 13.20 mL of 0.0374 M sample of $S_2O_3^{2-}$ were needed to completely titrate 10.00 mL of I^2 solution, the molarity of I^2 solution equals:
A) 0.136 B) 0.144 C) 0.0574 D) 0.0957 E) 0.0987

22. If ΔG_f° $SO_{3(g)}$ = -256.0 kJ/mol, ΔG_f° $SO_{2(g)}$ = -240.0 kJ/mol, then, ΔG° for the reaction: $2SO_{2(g)} \rightarrow 2SO_{3(g)} + O_{2(g)}$ equals:

A) - 140.0 B) - 360.0 C) 14.0 D) 210.0 E) 140.0

23. A process CANNOT be spontaneous if _____

A) it is endothermic, and there is an increase in entropy.
B) it is exothermic, and there is an increase in entropy.
C) it is endothermic, and there is a decrease in entropy.
D) the entropy of the universe increases.
E) it is exothermic, and there is a decrease in entropy.

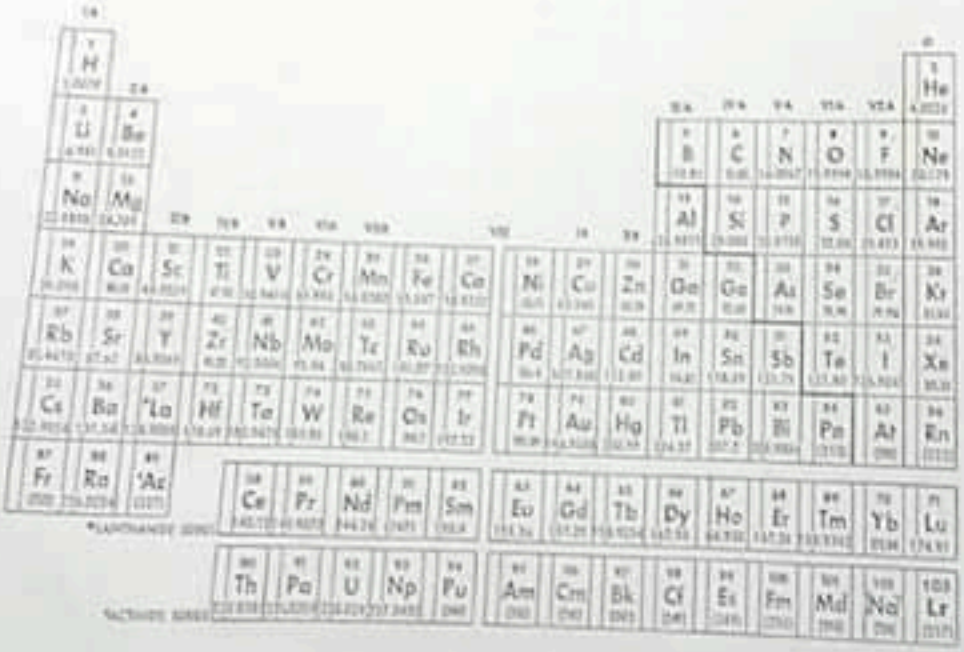
24. You need to prepare a solution in which CO_3^{2-} ions has a concentration of 0.602 M. The mass of K_2CO_3 (138.21 g/mol) needed to prepare 250 mL of this solution equals:

A) 2.07 B) 4.15 C) 20.8 D) 1.49 E) 10.4

25. The quantum numbers listed in the table describe five different electrons in the same atom. The correct arrangement of these electrons according to increase in energy is:

	n	l	m_l	m_s
I	4	0	0	½
II	3	2	1	½
III	3	2	-2	-½
IV	3	1	1	-½
V	3	0	0	-½

A) V > IV > II > I = III B) IV > I > II > V = III
C) V < IV < I < II = III D) II > V > III > I = IV
E) II = III > I > IV > V



required (in min) for the concentration of A to drop from 0.159 M to 6.07×10^{-3} mol/L equals:

a) 11.74 b) 104.45 c) 11.92 d) 10.02 e) 121.60

21- For the reaction: $CH_3NC \rightarrow CH_3CN$, $K = 6.3 \times 10^{-4}\ s^{-1}$, how long will it take (in s) for 50 % of CH_3NC be consumed?

a) 457 b) 684 c) 1100 d) 1666 e) 258

22- In a first order reaction, what fraction of material will remain after the passage of 2 consecutive half lives?

a) 1/8 b) 1/4 c) 1/32 d) 1/64 e) 1/16

23- The reaction $bB \rightarrow$ products, has a rate constant $K = 0.169\ M^{-1}.s^{-1}$. If the initial concentration of B = 0.59 M, then the first half life for this reaction (in s) equals:

a) 189.6 b) 23.7 c) 47.3 d) 94.8 e) 11.83

24- Given the following:

$4NO_{(g)} \rightarrow 2N_2O_{(g)} + O_{2(g)}$ $\Delta G^\circ = -139.56$ kJ

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ $\Delta G^\circ = -69.70$ kJ

The value of ΔG° for the reaction $2N_2O_{(g)} + 3O_{2(g)} \rightarrow 4NO_{2(g)}$ equals

a) – 0.32 b) – 0.16 c) + 0.16 d) + 0. 08 e) + 0.32

25- A catalyst increases the rate of the chemical reaction by :

a) Providing an alternative pathway with a lower value of E_a.
b) Providing an alternative pathway with a higher value of E_a.
c) Changing the products formed in the reaction.
d) Changing ΔH° enthalpy of reaction.
e) Decreasing ΔG° for the reaction.

26- The activation energy for a first order reaction equals 50.2 kJ/mol at 25 °C, the temperature (in K) at which the value of the rate constant K will be doubled equals:

a) 299 b 319.3 c) 308.6 d) 315.1 e) 326.3

Good luck and best wishes

AL-BALQA APPLED UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY
GENERAL CHEMISTRY (CHEM 101) FINAL EXAMINATION

Student name (in Arabic): ----------

DATE: 15 / 1/ 2009
TIME: 120 minutes

Instructor: ----------
Registration No: ----------

Time of lecture: ----------

Helpful data:

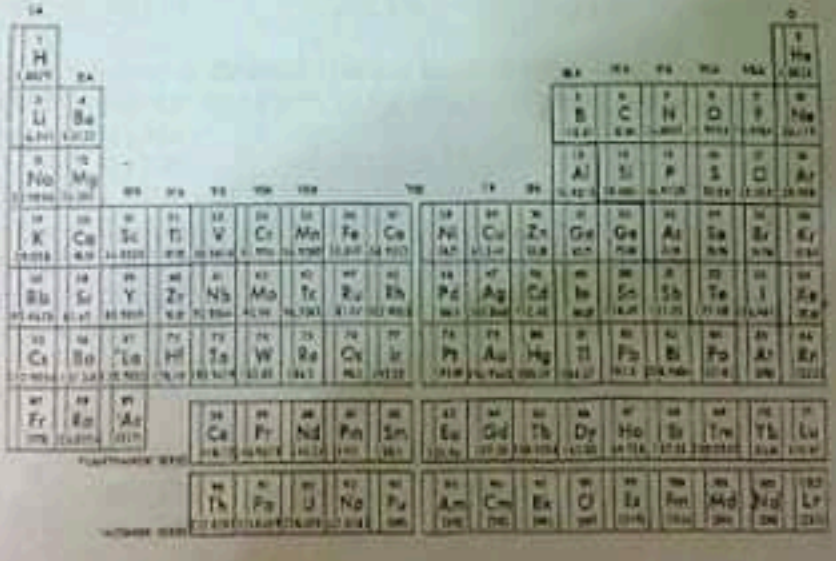
Avogadro's number: 6.022×10^{23} objects / mol; $R = 8.314$ J. mol^{-1}. K^{-1}; specific heat H_2O = 4.184 J.g^{-1}. °C^{-1}; $\ln(k_2/k_1) = -E_a/R\,(1/T_1 - 1/T_2)$ where $T1 > T_2$; (1 L. atm) = 101.325 J

- Choose the most correct answer for each of the following questions and transfer all your answers to the table below in capital letters

ANSWER SHEET

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer													

Question	14	15	16	17	18	19	20	21	22	23	24	25	26
Answer													



1- Which one of the following reactions represents the energy change associated with the 2nd electron affinity?

a) $O_{(g)} + 1e^- \rightarrow O^-_{(g)}$ b) $O^-_{(g)} + 1e^- \rightarrow O^{2-}_{(g)}$ c) $Na_{(g)} \rightarrow Na^+_{(g)} + e^-$
d) $Na^+_{(g)} + e^- \rightarrow Na_{(g)}$ e) $K_{(g)} - 1e^- \rightarrow K^+_{(g)}$

2- The electron configuration of indium In is:

a) [Kr] $5s^24d^{10}5p^1$ b) [Kr] $5s^24d^{10}5p^2$ c) [Kr] $5s^24d^{10}5p^3$ d) [Kr] $5s^24d^{10}$
e) [Kr] $5s^24d^{10}5p^4$

3- Based on what you've learned about quantum numbers, which of the following sets of quantum numbers for n, l, m_l and m_s is not possible?

a) 3, 1, -1, - ½ b) 3, 2, 2, 0 c) 4, 3, 2, + ½ d) 4, 3, -2, - ½ e) 5, 3, 2, + ½

4- The molar concentration of 98 % by mass H_2SO_4 solution whose density is 1.84 g/mL equals:

a) 16.9 b) 16.0 c) 18.4 d) 17.8 e) 15.0