Student ID .....

UNIVERSITY OF GHANA

BSC. ENGINEERING

FIRST SEMESTER EXAMINATIONS: 2016/2017

SCHOOL OF ENGINEERING SCIENCES

FAEN 107: GENERAL CHEMISTRY (3 CREDITS)

INSTRUCTIONS:

ANSWER SECTION A (OBJECTIVE SETS) AND THREE OTHER QUESTIONS FROM SECTION B

ANSWER SECTIONS A ON THE QUESTION PAPER AND B IN THE ANSWER BOOKLETS PROVIDED

TIME ALLOWED: TWO AND HALF ($2\frac{1}{2}$) HOURS

SECTION A: OBJECTIVE SETS [40 MARKS]

MARK THE CORRECT ANSWER(S) ON THE QUESTION PAPER AND MAKE SURE YOU WRITE YOUR STUDENT ID NUMBER ON THE TOP LEFT CORNER OF YOUR QUESTION PAPER

1. Consider the following reaction:

$$Ba + Cl_2 \rightarrow BaCl_2$$

Which of the following statements is true?

a. The barium atom is losing electrons; therefore, it is oxidized.
b. The chlorine atom is gaining electrons; therefore, it is oxidized.
c. The barium atom is gaining electrons; therefore, it is oxidized.
d. The chlorine atom is losing electrons; therefore, it is reduced.
e. none of these

2. True or false? Reduction is a gain of electrons.

a. True
b. False

3. In the reaction $2Ca(s) + O_2(g) \rightarrow 2CaO(s)$, the calcium is _____.

a. oxidized
b. electrolyzed
c. synthesized
d. reduced
e. none of these

4. In the reaction $2Sr(s) + O_2(g) \rightarrow 2SrO(s)$, Sr is

a. reduced
b. electrolyzed
c. galvanized
d. oxidized
e. none of these

5. The oxidation state of sulfur in K_2SO_3 is

a. +4
b. +6
c. +2
d. -2
e. 0

6. The oxidation state of chlorine in LiCl is

a. -1
b. +1
c. 0
d. -2
e. +2

7. The oxidation state of carbon in CO_2 is

a. 4
b. +2
c. 0
d. –2
e. –4

8. The oxidation state of sulfur in SO_4^{2-} is

a. 6
b. 2

Student ID .....

UNIVERSITY OF GHANA

BSC. ENGINEERING

FIRST SEMESTER EXAMINATIONS: 2016/2017

SCHOOL OF ENGINEERING SCIENCES

FAEN 107: GENERAL CHEMISTRY (3 CREDITS)

INSTRUCTIONS:

ANSWER SECTION A (OBJECTIVE SETS) AND THREE OTHER QUESTIONS FROM SECTION B

ANSWER SECTIONS A ON THE QUESTION PAPER AND B IN THE ANSWER BOOKLETS PROVIDED

TIME ALLOWED: TWO AND HALF ($2\frac{1}{2}$) HOURS

SECTION A: OBJECTIVE SETS [40 MARKS]

SELECT THE CORRECT ANSWER(S) ON THE QUESTION PAPER AND MAKE SURE YOU WRITE YOUR STUDENT ID NUMBER ON THE TOP LEFT CORNER OF YOUR QUESTION PAPER

1. Consider the following reaction:

$$Ba + Cl_2 \rightarrow BaCl_2$$

Which of the following statements is true?

a. The barium atom is losing electrons; therefore, it is oxidized.
b. The chlorine atom is gaining electrons; therefore, it is oxidized.
c. The barium atom is gaining electrons; therefore, it is oxidized.
d. The chlorine atom is losing electrons; therefore, it is reduced.
e. none of these

2. True or false? Reduction is a gain of electrons.

a. True
b. False

3. In the reaction $2Ca(s) + O_2(g) \rightarrow 2CaO(s)$, the calcium is _____.

a. oxidized
b. electrolyzed
c. synthesized
d. reduced
e. none of these

4. In the reaction $2Sr(s) + F_{2(g)} \rightarrow 2SrF_{2(s)}$, the fluorine is

a. reduced
b. electrolyzed
c. galvanized
d. oxidized
e. none of these

5. The oxidation state of sulfur in K_2SO_3 is

a. +4
b. +6
c. +2
d. -2
e. 0

6. The oxidation state of chlorine in $LaCl_3$ is

a. -1
b. +1
c. 0
d. -2
e. +2

7. The oxidation state of carbon in CO_2 is

a. 4
b. +2
c. 0
d. –2
e. –4

8. The oxidation state of sulfur in SO_4^{2-} is

a. 6
b. 2

c 4
d 0
e 8

9 The oxidation state of manganese in MnO_4^- is
a 0
b +3
c +4
d +7
e +8

10. The oxidation state of carbon in H_2CO_3 is
a 1
b +2
c. 0
d 6
e 2

11 - True or false? The frequency of the wave is the distance between two consecutive wave peaks.
a. True
b. False

12 True or false? The speed of a wave indicates how fast a given peak travels through water.
a. True
b. False

13 True or false? The frequency of the wave indicates how many wave peaks pass a certain point per given time period.
a. True
b. False

14. True or false? A packet of energy of electromagnetic radiation is called a neutron.
a. True
b. False

15. We usually use the term _____ for all forms of electromagnetic radiation.
a. energy

b. photons
c. radiation
d. light
e. none of these

16. The form of electromagnetic radiation (EMR) that has more energy per photon than ultraviolet rays but less energy per photon than gamma rays is
a. microwaves
b. radio waves
c. X rays
d. infrared rays
e. none of these

17. The form of electromagnetic radiation (EMR) that has less energy per photon than infrared rays but more energy per photon than radio waves is
a. microwaves
b. ultraviolet
c. gamma rays
d. X rays
e. none of these

18. Which color of visible light has the most energy per photon?
a. violet
b. blue
c. green
d. yellow
e. red

19. Which color of visible light has the least amount of energy per photon?
a. violet
b. blue
c. green
d. yellow
e. red

20. When an electron in the ground state absorbs energy, it goes to a(n) _____ state.
a. excited
b. lower

c. energetic

d.

e. stable

[illegible] kcal of energy is equivalent to how many joules?

a. 23.2212 J

b. 2.32212 × 10^2 J

c. 1.3264818355640535 J

d. 0.75387387387387395 J

e. 2.3221200000000004 × 10^4 J

[illegible] kcal of heat is equivalent to how many kilojoules of heat?

a. 3.6998087954110899 kJ

b. 0.27028423772609822 kJ

c. 6.4768320000000008 × 10^−2 kJ

d. 64.768320000000003 kJ

e. 6.4768319999999999 × 10^4 kJ

Express 3.27 × 10^5 J in kilocalories.

a. 1.3681679999999998 × 10^6 kal

b. 7.8154875717017207 × 10^4 kcal

c. 78.154875717017205 kcal

d. 327 kcal

e. 1.3681679999999998 × 10^3 kcal

Perform the indicated conversion: 38.859999999999999 kJ = _____ kcal

a. 1.6259024 × 10^2 kcal

b. 9.2877629063097515 kcal

c. 9.2877629063097498 × 10^3 kcal

d. 16.259024 × 10^−2 kcal

e. 0.10766855378281009 kcal

Perform the indicated conversion: 1.345 kcal = _____ J

a. 5.6274800000000003 × 10^3 J

b. 5.6274800000000003 J

c. 5.6274800000000003 × 10^−3 J

d. 321.46271510516249 J

e. 3.1107806691449817 J

26. Perform the indicated conversion: 7.078999999999997 kcal = _____ kJ

a. 29.618535999999999 kJ

b. 1.6919216061185467 kJ

c. 0.59104393275886424 kJ

d. $1.6919216061185469 \times 10^{3}$ kJ

e. $2.9618535999999995 \times 10^{-2}$ kJ

27. Perform the indicated conversion: $2.8700000000000001 \times 10^{3}$ cal = _____ J

a. 685.9464627151051 J

b. $1.2008080000000001 \times 10^{4}$ J

c. 12.00808 J

d. $6.859464627151052 \times 10^{5}$ J

e. $1.4578397212543555 \times 10^{-3}$ J

28. Determine the enthalpy change when 19.399999999999999 g of carbon is reacted with oxygen according to the reaction

$C(s) + O_2(g) \rightarrow CO_2(g) \qquad \Delta H = -394\,\text{kJ/mol}$

a. 636.43630308076604 kJ

b. $7.6435999999999993 \times 10^{3}$ kJ

c. –636.43630308076604 kJ

d. –7.6435999999999993 kJ

e. 6.7585012489592007 kJ

29. For the reaction

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l) \qquad \Delta H = -286\,\text{kJ/mol}$

Calculate the enthalpy change when 4.7300000000000004 g of hydrogen gas is reacted with excess oxygen.

a. –60.465116279069761 kJ

b. 671.02182539682553 kJ

c. –671.02182539682553 kJ

d. $1.3527800000000003 \times 10^{3}$ kJ

e. $-1.3527800000000003 \times 10^{3}$ kJ

30. A solution has $[H^+] = 5 \times 10^{-8}$ *M*. The pH of this solution is

a. 6.6989700043360187

b. 5.9810299956639813

c. 7.3010299956639813

d. 9.7710299956639819

e. none of these

31. A solution has $[H^+] = 4.2999999999999998 \times 10^{-8}$ *M*. The pOH of this solution is

a. 7.3665315444204138

b. 6.6334684555795862

c. 9.3734684555795873

d. 3.2834684555795861

e. none of these

32. Calculate the $[H^+]$ in a solution that has a pH of 5.54.

a. 8.46 M

b. 2.88403×10^{-6} *M*

c. 5.54 M

d. 4.5×10^{-6} *M*

e. none of these

33. A solution has a pH of 3.1600000000000001. The pOH of this solution is

a. 3.2600000000000002

b. 10.74

c. 3.1600000000000001

d. 10.84

e. none of these

34. A solution has $[OH^-] = 5 \times 10^{-4}$ *M*. The pH of this solution is

a. 3.3010299956639813

b. $1.9999999999999998 \times 10^{-11}$

c. 5.3494850021680094

d. 10.698970043336019

e. none of these

35. A solution has a pH of 4.4199999999999999. The $[H^+]$ in this solution is

a. $2.6302679918953813 \times 10^{-10}$ *M*

b. $3.8018939632056123 \times 10^{-5}$ *M*

c. 9.5800000000000001

d. 4.4199999999999999

e. none of these

36. Calculate the $[H^+]$ in a solution that has a pH of 8.8200000000000003.

a. 1.51356×10^{-6} M

b. 4.35×10^{-10} M

c. 2.056×10^{-8} M

d. 3.556×10^{-9} M

e. none of these

37. Calculate the $[OH^-]$ in a solution that has a pH of 3.7599999999999998.

a. 3.72 x10-10 M

b. 5.75 x 10-11 M

c. 6.01 x 10-10 M

d. 7.72 x 10-9 M

e. none of these

38. How many moles of pure NaOH must be used to prepare 1.0 L of a solution that ha pH = 12.26?

a. $8.1566068515497552 \times 10^{-16}$ mol

b. 0.018197008586099826 mol

c. $5.4954087385762476 \times 10^{-13}$ mol

d. 1.7400000000000002 mol

e. none of these

39. Calculate the pH of a 0.044999999999999998 *M* HCl solution.

a. 1.2267874862246564

b. 1.3467874862246563

c. 12.653212513775344

d. 12.293212513775345

e. none of these

40. The amount of energy needed to heat 2.00 g mercury from 50.0°C to 85°C is 9.8699999999999992 J. The specific heat capacity of this sample of mercury is

a. 0.14099999999999999 J/g·°C

b. 0.05805882352941176 J/g·°C

c. 0.2819999999999997 J/g·°C

d. 315.4499999999999 J/g·°C

e. 690.8999999999998 J/g·°C

[40 Marks]