GENERAL CHEMISTRY

MID EXAM

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1) In the following reaction:
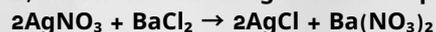
$2A + 3B \rightarrow 2C$

If 10.0 g of A (molar mass = 20 g/mol) reacts with excess B, and the percent yield is 50%, what is the actual mass of C formed, given that the molar mass of C is 96 g/mol?

A) 18.0 g
B) 20.0 g
C) 24.0 g
D) 30.0 g
E) 48.0 g

Ans : c

2) Given the following balanced equation:

$2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$

If 5.95 g of $AgNO_3$ reacts with excess $BaCl_2$, what mass of AgCl is formed assuming 100% yield?

A) 2.50 g
B) 5.00 g
C) 4.21 g
D) 7.50 g
E) 10.00 g

Ans : B

3) A buffer solution contains 0.500 M of HA and 0.368 M of NaA in a total volume of 1.00 L.
If 0.100 mol of HCl is added to the solution, what is the resulting pH? ($K_a = 1.8 \times 10^{-5}$)

A) 4.39
B) 4.74
C) 4.18
D) 4.90
E) 5.12

Ans : A

4) Which of the following nitrogen compounds has nitrogen in the (+4) oxidation state?

A) Dinitrogen oxide
B) Nitric acid
C) Sodium nitrite
D) Nitrogen dioxide
E) Ammonium chloride

Ans : D

5) In the reaction: $C + O_2 \rightarrow CO_2$, which of the following best describes the role of carbon (C)?

A) Acts as an oxidizing agent
B) Acts as a reducing agent
C) Undergoes reduction
D) Shows no change in oxidation state
E) Remains chemically inactive

Ans : B

6) What is the pH of a buffer solution containing 0.25 M hydrofluoric acid (HF) and 0.83 M sodium fluoride (NaF)?   (*K_a for HF = 7.2 $\times$ 10^{-4}*)

A) 3.14
B) 3.32
C) 3.50
D) 3.66
E) 3.91

Ans : D

7) When 60.0 mL of 1.00 M silver nitrate ($AgNO_3$) is mixed with 25.0 mL of 0.65 M sodium chloride (NaCl), a precipitate of silver chloride (AgCl) forms. Assuming complete reaction, what mass of silver chloride (AgCl) is produced? (*Molar mass of AgCl* = 143.3 *g/mol*)
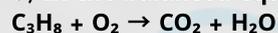
A) 1.55 g
B) 2.33 g
C) 3.12 g
D) 2.33 g
E) 4.78 g

Ans : D

8) Convert 421.1 K to its equivalent temperature in degrees Celsius?
A) 148°C
B) 148.0°C
C) 152.0°C
D) 694.0°C
E) −148.0°C

Ans : B

9) In the balanced equation for the combustion of propane (C_3H_8), what is the coefficient of water (H_2O)?
$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$
A) 2
B) 3
C) 4
D) 5
E) 6

Ans : C

10) Which of the following is the total sum of stoichiometric coefficients when the following reaction is balanced ?
$Fe(s) + O_2(g) \rightarrow Fe_2O_3(s)$
A) 7
B) 8
C) 9
D) 10
E) 11

Ans : C

11) Given five aqueous solutions of chloride salts, each with a known molarity and volume, which solution contains the largest total number of chlorine atoms in solution?
A) 212.0 mL of 0.472 M $CaCl_2$
B) 310.0 mL of 0.964 M NaCl
C) 386.0 mL of 0.259 M $AlCl_3$
D) 504.0 mL of 0.198 M $FeCl_3$
E) 259.0 mL of 0.578 M $MgCl_2$

Ans : C

12) Which of the following is the correct IUPAC name for the compound $Fe(NO_3)_3$?
A) Iron nitrate
B) Iron(II) nitrate
C) Iron(III) nitrate
D) Ferric nitrate
E) Iron(III) trinitrate

Ans : C

13) What is the correct IUPAC name for the oxoacid HNO_2?
A) Nitric acid
B) Hydronitric acid
C) Nitrous acid
D) Nitroxic acid
E) Hydrogen nitrite

Ans : C

14) Which of the following pairs of compound and name is INCORRECT?
A) KNO_3 — Potassium nitrate
B) $CaCl_2$ — Calcium chloride
C) Na_2CO_3 — Sodium carbonate
D) Na_2O_2 — Sodium oxide
E) $MgSO_4$ — Magnesium sulfate
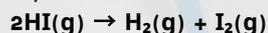
Ans : D

15) A sample contains 7.10 grams of $Ca(OH)_2$. What is the total number of moles of calcium hydroxide present in the sample?
A) 0.087 mol
B) 0.095 mol
C) 0.105 mol
D) 0.120 mol
E) 0.135 mol

Ans: B

16) For the reaction:
$2HI(g) \rightarrow H_2(g) + I_2(g)$
At T = 9°C, if Kc = 0.31, what is the correct value of Kp?   (R = 0.0821 $L \cdot atm/mol \cdot K$)
A) 0.007
B) 0.13
C) 0.24
D) 0.31
E) 0.41

Ans : D

17) A solution of nitric acid (HNO_3) , initially has a pH of 2 and a volume of 11.9 mL. After dilution, the pH changes to 4. Assuming ideal behavior and that the only change is due to dilution, what is the final volume of the solution?
A) 23.8 mL
B) 1.19 mL
C) 119.0 mL
D) 1178.1 mL
E) 1190.0 mL

Ans : E

18) A solution has a pH of 10.78. What is the hydroxide ion concentration $[OH^-]$, in mol/L?
A) 1.66×10^{-4} mol/L
B) 6.03×10^{-4} mol/L
C) 1.66×10^{-3} mol/L
D) 1.66×10^{-5} mol/L
E) 6.03×10^{-11} mol/L

Ans : B

19) Which of the following substances does NOT produce a basic solution when dissolved in water?
A) BaO
B) $Ca(OH)_2$
C) Na_2O
D) SO_2
E) KOH

Ans : D

20) Which of the following pairs can be classified as isotopes of the same element?
A) One atom has 11 p^+ and 12 n^0, the other has 12 p^+ and 11 n^0
B) One atom has 8 p^+ and 8 n^0, the other has 8 p^+ and 10 n^0
C) One atom has 7 p^+ and 7 n^0, the other has 6 p^+ and 7 n^0
D) One atom has 9 p^+ and 10 n^0, the other has 10 p^+ and 10 n^0
E) One atom has 17 p^+ and 18 n^0, the other has 18 p^+ and 17 n^0

Ans : B

21) Using the rules of significant figures, calculate the following ?
A) 14.5
B) 16
C) 15
D) 82
E) 14.9

$$\frac{8.167 + 68}{5.10}$$

Ans : C

22) Generally , observed behavior that can be formulated into a statement, sometimes mathematical in nature , is called a(n) ?
A) Observation
B) Measurement
C) Theory
D) Natural law
E) Experiment

Ans : D

23) Express 0.00560 in exponential notation:
A) 5.60
B) 5.60×10^{-3}
C) 5.60×10^{3}
D) 5.6×10^{-3}
E) None of these

Ans : B

24) An example of a pure substance is :
A) Pure water
B) Elements
C) Carbon dioxide
D) Compounds
E) All of these

Ans : E

25) A metric unit for length is :
A) gram
B) pound
C) yard
D) milliliter
E) kilometer

Ans : E

26) A compound is found to contain 22.2% titanium (Ti), 33.3% carbon (C), and 44.4% oxygen (O) by mass. What is the empirical formula of this compound?
A) TiCO
B) $Ti_2C_3O_4$
C) $Ti(CO)_2$
D) $Ti(CO)_3$
E) $Ti(CO)_6$

Ans : E

27) A compound is 92% carbon and 8% hydrogen by mass. What is the empirical formula of this compound?
A) CH
B) CH_2
C) CH_4
D) C_6H_6
E) C_6H_8

Ans : A

28) Which of the following is expected to have the highest boiling point based on the strength of intermolecular forces?
A) Xe
B) Br_2
C) Cl_2
D) N_2
E) O_2

Ans : B

29) Which of the following compounds contains the highest percent by mass of hydrogen?
A) H_2O
B) HF
C) HCl
D) H_2S
E) H_2SO_4

Ans : A

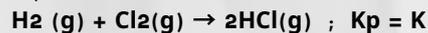30) For the reaction below at constant temperature:
A(g) + B(g) → C(g)
If additional C gas is added to the system, what will happen to the value of the equilibrium constant (K)?
A) It increases
B) It decreases
C) It becomes zero
D) It remains the same
E) It decreases temporarily then returns to its original value

Ans : D

31) Given the reaction below at a constant temperature:
H2 (g) + Cl2(g) → 2HCl(g) ; Kp = K
If the equation is reversed and halved, what is the new value of Kp in terms of the original K?
A) $K^{1/2}$
B) $1/K$
C) $1/K^{1/2}$
D) K^2
E) K

Ans : C

32) compound contains only carbon (C) and hydrogen (H). Its empirical formula is CH, and its molar mass is 104 g/mol. What is the molecular formula of the compound?
A) CH
B) C_2H_2
C) C_4H_4
D) C_6H_6
E) C_8H_8

Ans : E

33) Consider the following reaction at a constant temperature:
$2A(g) + B(g) \rightarrow 3C(g)$
At a certain moment, the concentrations are:
[A] = 0.50 mol/L , [B] = 0.20 mol/L , [C] = 0.10 mol/L
Given: (K = 5.0)
What can be concluded about the current state of the system?
A) Q < K, and the reaction will shift to the left
B) Q > K, and the reaction will shift to the left
C) Q = K, and the system is at equilibrium
D) Q < K, and the reaction will shift to the right
E) Q > K, and the reaction will shift to the right

Ans : D

34) A sample of 51.24 g of barium hydroxide is dissolved in water to make 1.931 L of solution.
How many moles of this solution must be taken and diluted with water to make 1.000 L of 0.100 M barium hydroxide solution?
A) 0.298 mol
B) 0.289 mol
C) 0.100 mol
D) 0.168 mol
E) 0.110 mol

Ans : C

35) Which of the following elements is expected to have chemical properties most similar to those of phosphorus ?
A) S
B) Se
C) O
D) As
E) Si

Ans : D

36) Which of the following is the correct name for the compound with the chemical formula Mg_3N_2?
A) Trimagnesiumdinitrogen
B) Trimagnesiumdinitride
C) Magnesium nitrogen
D) Magnesium nitride
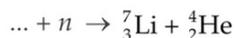E) Magnesium nitrite

Ans : D

37) A scientist obtains the number 0.045006700 on a calculator .
If this number actually has four (4) significant figures , how should it be written?
A) 0.4501
B) 0.045
C) 0.4567
D) 0.04500
E) 0.04501

Ans : E

38) Complete the following nuclear equation?

$$\ldots + n \rightarrow {}^{7}_{3}\text{Li} + {}^{4}_{2}\text{He}$$

? Which of the following nuclei correctly completes the reaction

A) ${}^{9}_{4}\text{Be}$

B) ${}^{9}_{5}\text{B}$

C) ${}^{10}_{5}\text{Be}$

D) ${}^{10}_{4}\text{B}$

E) ${}^{11}_{5}\text{B}$

Ans : A

39) The following table shows the successive ionization energies of an unknown element X:
Based on the data, which of the following is the most likely empirical formula for a stable compound formed between element X and phosphorus (P)?

A) XP

B) X_3P

C) X_3P_2

D) X_3P_4

E) X_2P_3

	Ionization Energy (kJ/mol)
First	730
Second	1450
Third	7700
Fourth	10,500

Ans : C

40) As part of the calibration of a new laboratory balance, a 1.000–g mass is weighed with the following results:

Trial	Mass
1	1.201 ± 0.001
2	1.202 ± 0.001
3	1.200 ± 0.001

The balance is:

A) Both accurate and precise.

B) Accurate but imprecise.

C) Precise but inaccurate.

D) Both inaccurate and imprecise.

E) Accuracy and precision are impossible to determine with the available information.

Ans : c

41) Consider the following three archery targets:
Which of the following figure(s) represent a result having high precision?

A) Figure I only

B) Figure II only

C) Figure III only

D) Figure I and Figure II

E) Figure II and Figure III

Ans : E

42) How many significant figures should be reported for the difference between 18.7378 mL and 18.57 mL?

A) 1

B) 2

C) 3

D) 4

E) 6

Ans : B

43) As warm water sits in a cool room, you measure the temperature change (ΔT = Tf − Ti). Which of the following is true ?
A) The temperature change (ΔT) is bigger if you are measuring in °F
B) The temperature change (ΔT) is bigger if you are measuring in °C
C) The temperature change (ΔT) will be the same regardless of the scale you use.
D) Answer A or B is correct, depending on the difference in temperature between the water and the room.
E) None of the above.

Ans : A

44) Which type of substance is most likely to dissolve in benzene but not in water ?
A) Ionic
B) Polar
C) Acidic
D) Non-polar
E) Basic

Ans : D

هذه جملةُ الأفكار التي وردت في امتحان الميد على وجه الدقّة، وقد ألحقتُ بها أربع مسائل إضافية وردت في كويزٍ تجريبيٍّ قُبيل الامتحان (23/24/25/37). قد تتفاوت الصياغة وتتبدّل الأرقام، غير أنّ المعنى محفوظٌ كما خُطّ في الأصل. وضعتُها بين أيديكم عوناً لمن أراد أن يُحكِّم الفهم ويبلغ الغاية.

ولا تنسونا من صالح دعائكم

محمد رمضان