Physical Chemistry

Choose the correct answer: **20 mark**

1. A mass of oxygen occupies 5.00 L under a pressure of 740 torr. At constant temperature, the volume of the same mass of gas at standard pressure (760 torr) will be …….. Note: use Boyle's law.

a - 4.87 L

b - 2.435 L

c - 3700 L

d - 3800 L

e - 0.9736 L

2. For a reversible reaction at equilibrium, ……..

a - $\Delta G° = 0$

b - $\Delta G° = -RT \ln K_{eq}$

c - $\Delta G = \Delta G° + RT \ln K_{eq}$

d - $\Delta G = \Delta G°$

e - $\Delta G = \Delta G° = 0$

3. If some stress (such as a change in temperature, pressure, or concentration) is brought to bear upon a system in equilibrium, a reaction occurs in the direction which tends to relieve the stress. This is called ……..

a - chemical equilibrium

b - third law of thermodynamics

c - Le Chatelier's principle

d - second law of thermodynamics

e. entropy

4. A reaction mechanism …….

a - is the sum of all steps in a reaction except the rate determining step.

b - has a ΔH equal to the ΔH of the most demanding step.

c - always has a rate determining step.

d - may be absolutely proven from the rate law.

e- is determined from balanced equation for a chemical reaction only.

5. The activation energy of a certain uncatalyzed reaction is 64 kJ/mol. In the presence of a catalyst, the Ea is 55 kJ/mol. How many times faster is the catalyzed reaction than the uncatalyzed one at 400°C? Assume that the frequency factor remains the same.

a - 5.0 times

b - 1.16 times

c - 15 times

d - 2.0 times

e - 0.2 times

6. How many electrons are delivered at the cathode during electrolysis by a current of 1A in 60 seconds?

a - 3.74×10^{20}

b - 6.0×10^{23}

c - 7.48×10^{21}

d - 6.0×10^{20}

e - 3.74×10^{22}

7. The Lagrange's equation is suitable for any coordinate system because it is in term of.....**.**

a - general coordinates

b - Cartesian coordinates

c - Spherical polar coordinates

d - Cylindrical coordinates

e - Cylindrical and cartesian coordinates

8. The equation $mc = \frac{h}{\lambda}$ indicates that the light behaves as.....**.**

a - Wave

b - Particle

c - Wave and particle

d – Photon

e- Wave and photon

9. Electromagnetic radiation emitted from a particle is composed primarily from..... at high temperatures.

a - high frequencies

b - low frequencies

c - high wavelengths

d - Very low wave numbers

e – high and low wave numbers

10. The function ψ in equation $\int\psi^2 d\tau = 1$ is called the..... function.

a - orthogonal

b - normalized

c - not normalized

d - not orthogonal

e – orthogonal and normalized

Inorganic Chemistry

Part I: Choose the correct Answer for each of the following:- 20 marks

11- Which molecule or ion has D_{2H} symmetry ?

(a) CO_3^{2-}

(b) SiF_4

(c) SeF_4

(d) $CH_2=CH_2$

12- Which of the following is a hard acid ?

a) F

b) O

c) Fe^{+3}

d) All the above

13- Magnetic susceptibility of complex$[NiCl_4]^{-2}$ is:

a) 0.5

b) 3.2B.M.

c) 2.8B.M.

d) 1.8B.M.

14- According to the Oracle diagram, which of the following complexes gives one transitions?

a- $[Co(NH_3)_6]Cl_2$,

b- $[Cu(CN)_6]Ca_2$

c- $[Ni(NH_3)_6]Cl_2$

d- $[Cr(en)_3]Cl_3$

15- The colour of Potassium dichromate due to:

a) d-d transition

b) charge transfer complexes

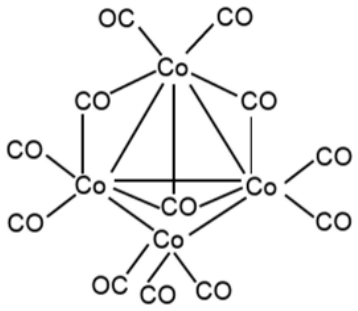
c) p-d transition

d) polarization of ion

Part II: Answer the following: 10 mark

Q1/ Consider a molecule IF_3O_2 (with I as the central atom). How many isomers are possible? Which is likely to have the lowest energy? Assign point group designations to each isomer. **5 mark**

Q2/ Explain Effective Atomic Number for Cobalt (Co) in the following complexes**:** **5 mark**



Analytical Chemistry

Choose the correct Answer for each of the following: 20 mark

16- In a chromatographic analysis of lemon oil a peak for limonene has a retention time of 8.36 min with a baseline width of 0.96 min. γ-Terpinene elutes at 9.54 min, with a baseline width of 0.64 min. the resolution between the two peaks is:

A. 1.44
B. 1.46
C. 1.48

D. 1.50

17-A chromatographic analysis for the chlorinated pesticide Dieldrin gives a peak with a retention time of 8.68 min and a baseline width of 0.29 min. Given that the column used in this analysis is 2.0 meters long, the height of a theoretical plate is:

A. 0.14 mm/plate
B. 0.16 mm/plate
C. 0.20 mm/plate
D. 0.22 mm/plate

18-A spectrophotometric method for the quantitative determination of the concentration of Pb^{2+} in blood yields an S_{samp} of 0.193 for a 1.00-mL sample of blood that has been diluted to 5.00 mL. A second 1.00-mL sample is spiked with 1.00 µL of a 1560-ppb Pb^{2+} standard and diluted to 5.00 mL, yielding an S_{spike} of 0.419. the concentration of Pb^{2+} in the original sample of blood is

A. 1.27 ppb
B. 1.29 ppb
C. 1.31 ppb
D. 1.33 ppb

19- The mobile phase in gas chromatography if the detector is electron capture is:

A. Ar
B. N_2
C. He
D. H_2

20- The order of the following compounds (1-isobutanol 2- ethyl acetate 3-acetaldehyde 4- acetic acid from the long retention times in gas chromatography is:

A. (1>2>3>4)

B. (1>3>2>4)

C. (4>1>2>3)

D. (3>4>2>1)

21- At glass transition temperature the segmental mobility of polymer chains is:

A. Increases and polymer is more elastic

B. reduces and polymer is more elastic

C. Increases and polymer is more rigid

D. reduces and polymer is more rigid

22- Two types of DSC instruments are widely used is:

A. Total consumption burner and heat flux

B. premix flow burner and power compensated

C. premix flow burner and heat flux

D. heat flux and power compensated

23- The size of glass transition …….. with increasing amount of amorphous structure.

A. Increases

B. reduces

C. not changes

D. sometime increases and sometime reduces.

24- The onset of a true melting peak will shift very little with change the heating rate from 1 to 20 ^{0}C/min. while evaporating peak will shift by:

A. 5

B. 10

C. 15

D. 20 ^{0}c/min

25- A flame in which sufficient the oxidant gas to the fuel gas supplying the flame is a:

A. fuel-rich flame

B. oxidant-poor flame

C. clean flame

D. fuel-poor flame

Good luck