Physical chemistry

Choose the correct answer: (20 mark)

1. Which of the following is a characteristic of an adiabatic process?

A - $\Delta U = 0$

B - $W = 0$

C - $Q = 0$

D – $\Delta V = 0$

E- $\Delta P = 0$

2. Two moles of a gas undergo expansion from volume V to 10V at a temperature of 27°C. The work done in the process in J is **.....**

A- 4.5×10^2

B- 1.0×10^3

C- 5.0×10^3

D- 1.1×10^4

E- 3.0×10^3

3. What is the name of the following statement: "When two systems are in thermal equilibrium with a third system, then they are in thermal equilibrium with each other"?

A- First Law of Thermodynamics

B- Second Law of Thermodynamics

C- Mechanical equivalent of heat

D- Zeroth Law of Thermodynamics

E- None of these

4. The purpose for use of the salt bridge in an electrochemical cell is to **.....**

A- provide a source of ions to react at the anode and cathode.

B- provide oxygen to facilitate oxidation at the anode.

C- provide a means for electrons to travel from the anode to the cathode.

D- provide a means for electrons to travel from the cathode to the anode.

E- maintain electrical neutrality in the half-cells via migration of ions.

5. Number of electrons involved in the electrodeposition of 63.5 g of Cu from a solution of $CuSO_4$ is:

A- 6.022×10^{23}

B- 3.011×10^{23}

C- 12.044×10^{23}

D- 6.022×10^{22}

E- 24.088×10^{22}

6. At 25°C, the rate constant for the first-order decomposition of a pesticide solution is 6.40×10^{-3} min^{-1}. If the starting concentration of pesticide is 0.0314 M, what concentration will remain after 62.0 min at 25°C?

A- 1.14×10^{-1} M

B- 47.4 M

C- 8.72.0 M

D- 2.11×10^{-2} M

E- 2.68 × 10-2 M

7. Newton's second law of motion is **.....**

A- F = -kx

B- $-kx = m\dot{x}$

C- $-kx = \frac{d^2x}{dt^2}$ m

D- $+kx = \frac{d^2x}{dt^2}$ m

E- None of them

8. The equation $\hat{\Lambda}f = \lambda f$ is the Eigen function where λ is**.....**

A- Eigen value

B- linear operator

C- complex value

D- not Eigen value

E- none of them

9. Heisenberg's uncertainty principle states that both the position and ..... of a particle can't be determined with finite accuracy and instantaneously.

A- momentum

B- mass

C- energy

D- time

E- velocity

10. The Hamiltonian operator is the..... factor.

A- moment

B- time

C- energy

D- potential energy

E- kinetic energy

Analytical chemistry

Choose the correct answer **20 mark**

11-If the mole fraction of metal is 0.25. the formula of complex is

a. M4L
b. ML4
c. M2L4
d. M4L2

12- When dissolve 0.526 g from Cd(NO3)2 [Mw = 236.4] in 250 ml of distil water the concentration of cadmium[Atomic mass = 112.4] in this solution is

a. 1ppm
b. 10 ppm
c. 100 ppm
d. 1000 ppm

13- The pH of solution that is 0.02 M in NH3 and 0.03 M in NH4Cl after adding 1.00 ml of 0.1M NaOH to 0.10 liter of this solution is (p Kb = 9.24)

a. 9.1
b. 9.2
c. 9.3
d. 9.4

14- The electrode potential of the following half-cell against the standard hydrogen electrode is

Ag|AgBr (sat, d), Br- (3.00M) $E^0 = 0.095$ v

a. 0.068 v
b. 0.0594v
c. 0.067v
d. 0.295v

15- The ionic strength of solution that is 0.0036 M BaCl2 and 0.04 M NaCl is

a. 0.050
b. 0.051
c. 0.052
d. 0.053

16- Name the process that contaminates the precipices and also carries the precipitate solution containing soluble impurities.

a. Coprecipitation

b. Supersaturation

c. Repreciptation

d. None of the above

17- For AB_2 or A_2B of salts like $Mg(OH)_2$ and Ag_2CrO_4, solubility is S then solubility product is equal to…….

a. $4S^3$

b. S^2

c. $4S^2$

d. $2S^3$

18- What weight of Fe_2O_3 precipitate would be obtained from a 0.4823gm sample of iron wire that
is 99.89% pure?

a. 0.699

b. 0.482

c. 0.586

d. 0.688

19- Solvent extraction is more effective when the extraction is repeated with:

a. Extra solvent
b. Large solvent
c. Small solvent
d. No solvent

20- When the component has a small value of K, it is supposed to have an affinity for:

a. Mobile phase

b. No phase

c. Stationary phase

d. Whole solution

Biochemistry

Choose the correct Answer: 20 mark

21- How many steps of urea cycle occur in liver mitochondria and cytosol?

A- 3 steps in mitochondria and 3steps in cytosol.

B- 3 steps in mitochondria and 2steps in cytosol.

C- 2 steps in mitochondria and 3steps in cytosol.

D- 3 steps in mitochondria and 1steps in cytosol.

E - 2 steps in mitochondria and 2steps in cytosol.

22- Which are amino acids have Aromatic R groups?

A-Lys, Tyr, Cys.

B- Asp, Met ,Trp.

C- Lys, Phe, Val.

D-Trp, Tyr, Phe.

E- Gln,GLu,Gly

23- Identify the purine base of nucleic acids in the following.

A- Cytosine

B-Thymine

C- Uracil

D- Adenine

E- caffeine

24- Which of these is true of the endocrine system

A- secretes hormones that are transported to target cells by blood

B- causes changes in metabolic activities

C- effects are prolonged

D- Endocrine glands are ductless and exocrine glands release secretions at the body's surface or into ducts

E- All of above are true

25- The glycosaminoglycan that serves as an anticoagulant

A- Heparin

B- Hyaluronic acid

C- Chondroitin sulfate

D- Dermatan sulfate

E- Vitamin K

26- The following polysaccharide is composed of β-glycosidic bonds

A- Starch

B- Glycogen

C- Dextrin

D- Cellulose

E- all the above

27- The carbon atoms involved in the osazone formation

A- 1 and 2

B- 2 and 3

C- 3 and 4

D- 5 and 6

E- 1 and 5

28- A 20-carbon fatty acid among the following is:

A- Linoleic acid

B- α -Linolenic acid

C- β -Linolenic acid

D- Oleic acid

E- Arachidonic acid

29- Cholesterol is the precursor for the biosynthesis of:

A- fatty acid

B- prostaglandins

C- bile acids

D-sphingomyelin

E- Proteins

30- Deficiency of vitamin D causes:

A- Ricket and osteomalacia

B- Tuberculosis of bone

C- Hypothyroidism

D- Skin cancer

E- Renal failure

Organic chemistry

Choose the correct answer: 20 mark

31. Which of the following is the simplest member of organic compounds?

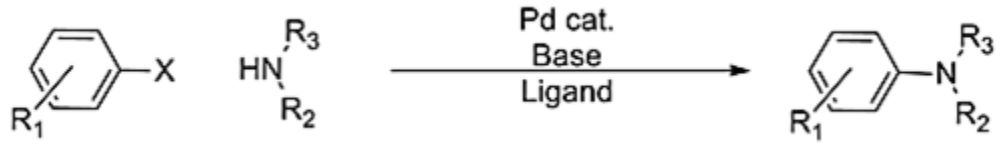
a) Formic acid

b) Formaldehyde

c) Methane

d) Methanol

32. Which of the following is the known name for the reaction given below?



(where, X=Cl, Br, I, OTf; R_2=Alkyl, aryl, H; R_3=alkyl, aryl)

a) Ullmann reaction

b) Gabriel phthalimide synthesis

c) Buchwald-Hartwig Reaction

d) Chan-Lam coupling

33. Which of the following is yielded when Ethylene glycol is treated with phosphorus tri-iodide?
a) ethylene di-iodide
b) ethylene
c) ethane
d) ethyl iodide

34. Hydrocarbons are organic compounds with element _____
a) Both hydrogen and carbon
b) Carbon
c) Hydrogen
d) Oxygen

35. Which of the following bond is made up of a large number of organic compounds?
a) Metallic bond
b) Dipolar bond

c) Ionic bond
d) Covalent bond

36- An organic compound (MF; C8H10O) exhibited the following 1H NMR special data: 62.5 (3H, s), 3.8 (314, s), 6.8 (2H, d, J 8 Hz), 7.2 (2H, d, J 8 Hz) ppm. Which of the following is that compound among the choices?

a) 4-methylbenzyl alcohol
b) 4-methyl anisole
c) 4-ethylphenol
d) 2-ethylphenol

37- Geometric isomerism is usually found in

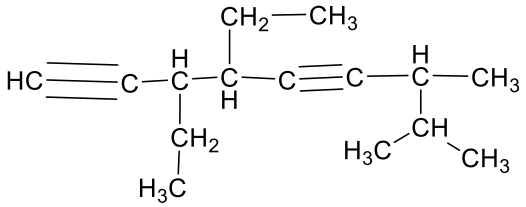
A. Alkanes

B. Alkenes

C. Alkynes

D. Esters

38- the IUPAC Name of the following structure is



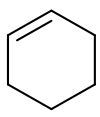
a) 3,4-diethyl-7,8-dimethylnona-1,5-diyne

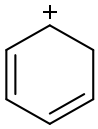
b) 3,4-diethyl-7,8-dimethylocta-1,5-diyne

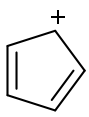
c) 3-acetyl-4-diethyl-7,8-dimethylnona-5-diyne

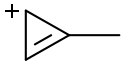
d) 3,4-diethyl-8-dimethylnona-1,5-diyne

39- Which of the following compounds have antiaromatic properties?

a) 

b) 

c) 

d) 

a) a

b) b

c) c

d) d

40- Which of the following organic compound is formed when aniline reacts with acetaldehyde?

a) Diazonium salt
b) Immine
c) Schiff's base
d) Carbylamine

Inorganic chemistry

Part I: Choose the correct answer: 14 mark

41. Based on VSEPR theory, H_2O molecule has the following shape:
    a. Bent
    b. Trigonal pyramidal
    c. Tetrahedral
    d. Trigonal planner

42. The oxidation state of Chromium ion in the complex $[Cr(CO)_6]$ is:
    a. +2
    b. +1
    c. 0
    d. -1

43. The principle of the molecular orbital theory (MOT) includes:
    a. A molecular orbitals MO combination to form linear atomic orbitals AO
    b. A linear combination of molecular orbitals (LCMO) to form molecular orbitals MO

c. A linear combination of atomic orbitals (LCAO) to form molecular orbitals MO
d. All of above

44. If the electron configuration of the octahedral complex with low spin ligand field is $t_2g^5\ eg^2$, the CFSE ((10Dq) Δ_o) will be:
a. $-0.8\Delta_o+2p$
b. $-1.8\Delta_o+3p$
c. $-1.8\Delta_o$
d. $1.8\Delta_o+p$

45. The hybridization of the central atom and the geometry of the molecular shape in the complex $[Fe(CN)_6]^{-3}$ are:
a. d^2sp^3 and T_d
b. d^2sp^3 and O_h
c. sp^3d^2 and T_d
d. sp^3d^2 and O_h

46. Based on the crystal field theory (CFT), the d-orbitals split into two different levels:
a. eg and a_1g
b. a_1g and t_2g
c. a_1g and a_2g
d. t_2g and eg

47. The difference between the complexes and the compounds is:
a. Atomic number
b. coordination bonds
c. oxidation state
d. others

Part II:

Answer the following questions about $[Co(CN)_6]^{3-}$ and $[Co(F)_6]^{3-}$: 6 marks

1. Why do they have different numbers of unpaired electrons?
2. Which one of them has higher Δ_o?
3. Which one of them has higher magnetic properties?
4. Why the Co atom classify as transition metal?

Good luck