M.Sc. Part I Sem I Mock exam paper

Subject Chemistry Paper I Physical Chemistry

1. The de- Broglie wavelength of a particle having KE E_k is given by

a) $\lambda = h/\sqrt{E_k}$

b) $\lambda = h/\sqrt{2mE_k}$

c) $\lambda = h/\sqrt{mE_k}$

d) $\lambda = h/\sqrt{3mE_k}$

2. The de- Broglie wavelength of a charge q and accelerated through a potential difference of V volts is
   a) $\lambda = h/\sqrt{mqv}$
   b) $\lambda = hm/\sqrt{qV}$
   c) $\lambda = h/\sqrt{2mqV}$
   d) $\lambda = h/mqV$

3. Identify which of the following operators is not hermitian?
   a) $h/i \, .d/dx$
   b) id^2/dx^2
   c) d^2/dx^2
   d) x^2
4. A particle is constrained in one dimensional box of length 2a with potential $V(x) = \infty$; $x < -a, x > a$ and $V(x) = 0$; $-a \leq x \leq a$. Energy difference between levels n= 3 and n=2 is
   a) $5h^2/8ma^2$
   b) $9h^2/8ma^2$
   c) $9h^2/32ma^2$
   d) $5h^2/32ma^2$

5. If A and B are non-commuting hermitian operators, all eigen values of the operator given by
   a) complex

b) real
c) imaginary
d) zero

6. The degeneracy of an excited state of a particle in 3-dimensional cubic box with energy three times its ground state energy is
   a) 3
   b) 2
   c) 1
   d) 4

7 In a cyclic process

a) work done is zero
b) work done by the system is equal to the quantity of heat given to the system
c) work done does not depend on the quantity of heat given to the system
d) the internal energy of the system increases

8 for a thermodynamic system , work done in a process depends upon

a) the path
b) state of the system
c) external pressure
d) nature of the system

9. At _____temperature , the Joule Thomson coefficient is _____

a) inversion temperature , zero

b) inversion temperature, 1

c) critical temperature, zero

d critical temperature, 1

10.the unit of the van der Waal's constant,a, are

a) m^3.Mol

b) $N^2m^4mol^2$

c) $Nm^2 mol^{-4}$

d) $Nm^4 mol^{2-}$

11.For a thermodynamic system, Helmholtz free energy is a function of

a) S,V

b) V,T

c) T,p

d) S,p

12. which among the following sets for Maxwell relation is correct?

(U= internal energy, H= enthalpy, A= Helmholtz fre energy and G = Gibb's free energy)

a) $T = [\delta U/\delta V]_S$ and $p = [\delta U/\delta S]_V$

b) $V = [\delta H/\delta p]_S$ and $T = [\delta H/\delta S]_p$

c) $p = [\delta G/\delta V]_T$ and $V = [\delta G/\delta S]_S$

d) $p = [\delta A/\delta S]_s$ and $V = -[\delta A/\delta p]_V$

13. the rate of a chemical reaction generally increase rapidly even for small temperature increase because of rapid increase in the

a) collision frequency

b) fraction of molecules with energies in excess of the activation energy

c) activation energy

d) average kinetic energy of molecules

14. If I is the intensity of absorbed light and C is the concentration of AB for the photochemical reaction, $AB + h\nu \rightarrow AB^*$, the rate of formation of AB* is directly propotional to

a) C

b) I

c) I^2

d) C.I

15. the esterification of aceticanhydride (A) by ethyl alcohol(B) can be shown as

$(CH3CO)2O + C2H5OH \rightarrow CH3COOC2H5 + CH3COOH$

Select the correct statement

a) In dilute hexane solution, rate is k[A][B]
b) In ethyl alcohol as solvent, rate is k[A]
c) In ethyl alcohol,reaction is pseudo first order
d) All the above are correct statements

16. During the course of chemical reaction, the frequency factorA in Arrhenius equation is directly related to

a) the entropy change in the reaction

b) the free energy change in the reaction

c) the energy of activation in the reaction

d) change in entropy and free energy in the reaction

17. the mean activity coefficient of 0.001 molal Na2S2O4 solution is

a) 0.879

b) 0.246

c) 0.571

d) 0.369

18. In the electrochemical reaction

$2Fe^{3+} + Zn \rightarrow Zn^{2+} + 2Fe^{2+}$

increasing the concentration of Fe^{2+}

a) increases cell emf
b) increases the current flow
c) decrease the cell emf
d) alter the pH of the solution

19 The fuel cell reaction generates electricity directly from H_2 and O_2. The net reaction is $2H_2 + O_2 \rightarrow 2H_2O$. What potential should the battery generate (under standard conditions)?

a) 0.40
b) 0.43
c) 0.68
d) 1.23

20 Which of the following increases with increase in concentration?

a) conductance
b) specific conductance
c) equivalent conductance
d) molar conductance

21. Calculate the number of H^+ ions present in 1mL of a solution whose pH is 10

a) $1x10^{-13}$

b) 6.02×10^{10}

c) $1X\ 10^{-10}$

d) $6.02x10^{13}$

answer key

1 b

2 c

3 b

4 d

5 c

6 a

7 b

8 a

9 a

10 d

11 b

12 b

13 b

14 b

15d

16a

17 a

18 c

19d

20b

21 b