

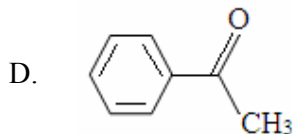
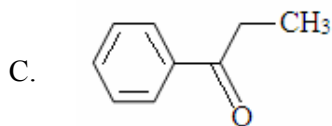
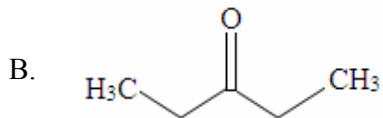
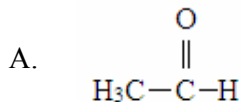
**CHEMISTRY – PG 2016 Final**

- 1) What is the empirical formula of a compound that contains 72g carbon, 18g hydrogen and 192g oxygen? (The masses of H, C and O are 1, 12 and 16)
- A.  $\text{CH}_4\text{O}_4$   
B. CHO  
C.  $\text{CH}_3\text{O}_2$   
D.  $\text{CH}_4\text{O}_2$
- 2) What kind of orbitals do the nonbonding electrons of the oxygen in an alcohol occupy?
- A. They occupy s orbitals  
B. They occupy  $\text{sp}^2$  orbitals  
C. They occupy sp orbitals  
D. They occupy  $\text{sp}^3$  orbitals
- 3) Steam distillation would be the appropriate method of distillation for which of the following?
- A. Diethyl ether and water  
B. Ethyl alcohol and water  
C. Aniline and sodium chloride  
D. None of these
- 4) An organic compound (0.2g) containing carbon, hydrogen and oxygen yielded on combustion 0.14g of  $\text{CO}_2$  and 0.12g of  $\text{H}_2\text{O}$ . The percentage composition of the compound is
- A. C=19.90%, H=6.66%, O=74.24%  
B. C=25%, H=1.66%, O=73.34%  
C. C=66.7%, H=11.1%, O=22.2%  
D. C=30%, H=3%, O=67%
- 5) Which of the following have lowest dipole moment?
- A. Carbon tetrachloride  
B. Chloromethane  
C. Dichloromethane  
D. Chloroform

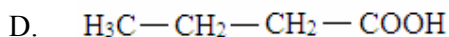
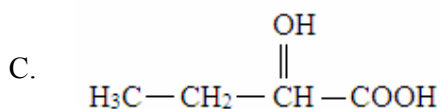
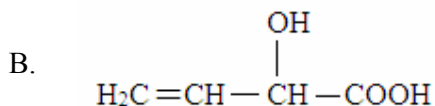
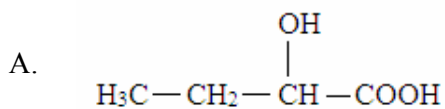
- 6) Optical isomerism is shown by
- A. *n*-butyl chloride
  - B. *sec*-butyl chloride
  - C. *tert*-butyl chloride
  - D. isobutyl chloride
- 7) LPG is a mixture of
- A. methane+ethane
  - B. O<sub>2</sub> + Acetylene
  - C. butane + Isobutane
  - D. acetylene + H<sub>2</sub>
- 8) Baeyer's reagent is
- A. dil KMnO<sub>4</sub>
  - B. HCl + ZnCl<sub>2</sub>
  - C. Br<sub>2</sub> in CCl<sub>4</sub>
  - D. NH<sub>2</sub>NH<sub>2</sub>
- 9) 1,3-butadiene reacts with bromine to mainly give
- A. 3,4-dibromo-1-butene
  - B. 4-bromo-1-butene
  - C. 1,4-dibromo-2-butene
  - D. 1-bromo-2-butene
- 10) Ozonolysis of 2-butyne gives
- A. formic acid
  - B. propanoic acid
  - C. acetic acid
  - D. butanoic acid
- 11) Which compound would react most rapidly in an S<sub>N</sub>2 reaction?
- A. CH<sub>3</sub>CH<sub>2</sub>I
  - B. CH<sub>2</sub>=CH-I
  - C. (CH<sub>3</sub>)<sub>2</sub>CHI
  - D. (CH<sub>3</sub>)<sub>3</sub>CI
- 12) Which compound will give *tert*-butyl alcohol with methyl magnesium bromide?
- A. Acetyl chloride
  - B. Acetone
  - C. Isopropyl alcohol

D. Acetaldehyde

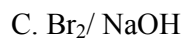
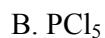
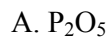
- 13) Isopropyl alcohol can be converted to acetone by treatment with
- HCl/ZnCl<sub>2</sub>
  - Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> / H<sub>2</sub>SO<sub>4</sub>
  - NaOH
  - LiAlH<sub>4</sub>
- 14) Compound (A) reacts with sodium metal to form one mole of H<sub>2</sub>. The compound (A) can be
- CH<sub>3</sub>CH<sub>2</sub>CH=CH<sub>2</sub>
  - HOCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH
  - CH<sub>2</sub>=CH-CH=CH<sub>2</sub>
  - CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH
- 15) Compound (A) gave a positive iodoform test, but did not reduce silver metal in ammonia solution. Compound (A) could be



16) 2-bromobutyric acid  $\xrightarrow[\text{reflux}]{\text{NaOH}}$  (A) + NaBr  
 (A) can be



17) Acetamide can be converted to methylamine by



18) Hydrolysis of an ester can be accomplished by

A. base-promoted hydrolysis

B. acid-catalyzed hydrolysis

C. Both of the above

D. Neither of the above

19) Diethyl malonate reacts with urea to give

A. butyric acid

B. barbituric acid

C. glutaric acid

D. mandelic acid

20) The degree of unsaturation of a fat can be determined by means of its

A. iodine number

B. octane number

C. saponification

D. melting point

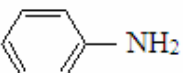


21) Which of the following compounds react with nitrous acid to form an alcohol?

A.  $\text{CH}_3\text{CH}_2\text{NH}_2$

B.  $(\text{CH}_3\text{CH}_2)_2\text{NH}$

C.  $(\text{CH}_3\text{CH}_2)_3\text{N}$

D. 

22) Glycine reacts with nitrous acid to form

A. glycollic acid

B. diketopiperazine

C. methylamine

D. ethylalcohol

23) Which molecule will decolourize bromine in carbon tetrachloride most readily?

A. 1,2-dimethylcyclopropane

B. Cyclopentane

C. 1,2-dimethylcyclobutane

D. Cyclohexane

24) Uric acid on oxidation with alkaline  $\text{KMnO}_4$  forms

A. urea

B. barbituric acid

C. allantoin

D. caffeine

25)  $\alpha$ -D-glucopyranose is a (n)

A. hemiacetal

B. hemiketal

C. acetal

D. ketal

26) How many signals will vinyl chloride have in its proton NMR spectrum?

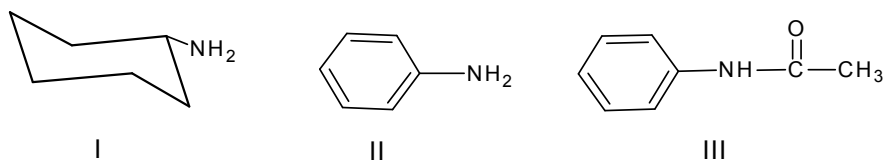
A. 4

B. 1

C. 3

D. 2

27) What is the order of basicity (most basic to least)?



- A. I, II, III  
 B. I, III, II  
 C. III, II, I  
 D. II, I, III

28) Naphthalene undergoes oxidation with  $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$  to form

- A. Phthalic acid  
 B. Benzoic acid  
 C. Tetralin  
 D. Decalin

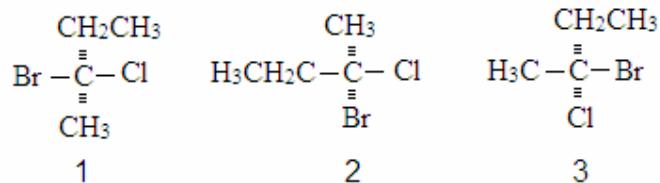
29) The aromaticity of the heterocycles is in the order

- A. Thiophene > pyrrole > furan > pyridine  
 B. Furan > pyrrole > thiophene > pyridine  
 C. Pyridine > thiophene > pyrrole > furan  
 D. Pyridine > furan > pyrrole > thiophene

30) The Lindlar catalyst is

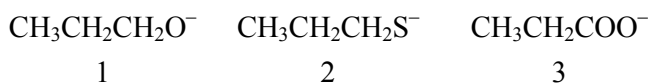
- A. Na in alcohol  
 B. Raney nickel  
 C. Pd /  $\text{CaCO}_3$   
 D. Na /  $\text{LiqNH}_3$

31) Which of the following depict the same stereoisomer?



- A. 1 and 2  
 B. 1 and 3  
 C. 2 and 3  
 D. 1, 2 and 3

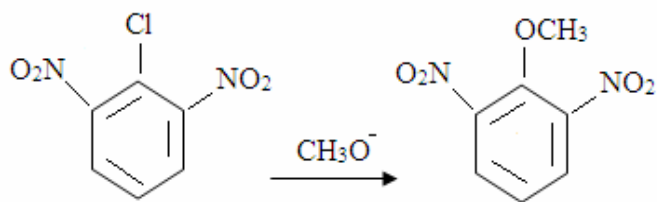
- 32) Rank the following species in order of decreasing nucleophilicity in a polar protic solvent (most  $\rightarrow$  least nucleophilicity).



- A.  $3 > 1 > 2$   
 B.  $2 > 3 > 1$   
 C.  $1 > 3 > 2$   
 D.  $2 > 1 > 3$
- 33) Which of the following are pyrimidines?  
 1. Adenine    2. Cytosine    3. Guanine    4. Thymine
- A. 1, 2  
 B. 1, 3  
 C. 1, 4  
 D. 2, 4
- 34) A D carbohydrate is
- A. always dextrorotatory  
 B. always levorotatory  
 C. always the anomer of the corresponding  
 D. None of the above
- 35) The optical rotation of the  $\alpha$ -form of a pyranose is  $+150.7^\circ$  and that of the  $\beta$ -form is  $+52.8^\circ$ . In solution an equilibrium mixture of the anomers has an optical rotation of  $+80.2^\circ$ . The percentage of the  $\alpha$ -form at equilibrium is
- A. 28%  
 B. 32%  
 C. 68%  
 D. 72%
- 36) Which of the following reactions is more effective?  
 I.  $\text{C}_6\text{H}_5\text{ONa} + \text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \rightarrow$   
 II.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{ONa} + \text{C}_6\text{H}_5\text{Br} \rightarrow$
- A. Reaction I is more effective  
 B. Reaction II is more effective  
 C. Both reactions I and II are effective  
 D. Neither reaction I nor reaction II is effective

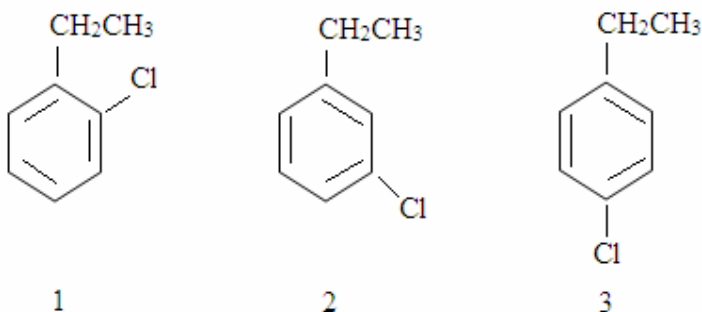


37) The reaction

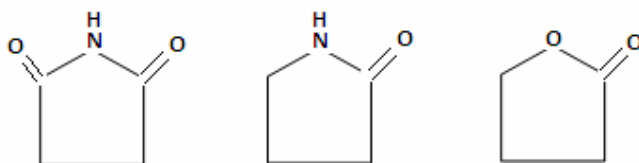


most likely occurs by which of the following mechanisms?

- A. Addition - elimination
  - B. Elimination - addition
  - C. Both (A) and (B)
  - D. Neither of these
- 38) Which of the following compounds gives a single benzyne intermediate on reaction with sodium amide?



- A. 1 only
  - B. 1 and 3
  - C. 3 only
  - D. 1 and 2
- 39) Choose the response that matches the correct functional group classification with the following group of



- |              |         |           |
|--------------|---------|-----------|
| A. Anhydride | Lactam  | Lactone   |
| B. Lactam    | Imide   | Lactone   |
| C. Imide     | Lactone | Anhydride |
| D. Imide     | Lactam  | Lactone   |

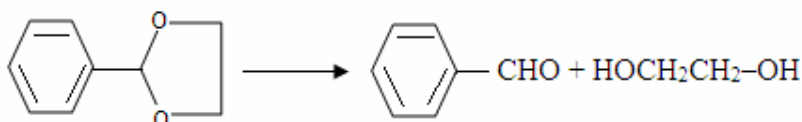
- 40) Which of the following pairs of aldehydes gives a single product in a mixed aldol condensation?
- A.  $\text{C}_6\text{H}_5\text{CH}_2\text{CHO} + \text{C}_6\text{H}_5\text{CHO}$
  - B.  $\text{C}_6\text{H}_5\text{CHO} + \text{CH}_2\text{O}$
  - C.  $\text{C}_6\text{H}_5\text{CHO} + (\text{CH}_3)_3\text{CCHO}$
  - D.  $\text{CH}_3\text{CHO} + (\text{CH}_3)_2\text{CHCHO}$
- 41) Which of the following is a linear polymer?
- A. High density polythene
  - B. Low density polythene
  - C. Bakelite
  - D. Vulcanized rubber
- 42) Bakelite is the product of the reaction between
- A. formaldehyde and NaOH
  - B. aniline and urea
  - C. phenol and methanol
  - D. phenol and chloroform
- 43) Dettol consists of
- A. xylenol + terpeneol
  - B. chloroxylenol + terpeneol
  - C. cresol + ethanol
  - D. None of the above
- 44) Which of the following is an ester?
- A. Kerosene oil
  - B. Soap
  - C. Bees wax
  - D. Peptoses
- 45) Isopropylamine  $\longrightarrow$  X  $\longrightarrow$  Y. In the above sequence X and Y are respectively
- A. Acetaldimine, Ethanol
  - B. Ethanol, Ketimine
  - C. Ketimine, Acetone
  - D. Acetone, Propan-2-ol

- 46) Green Chemistry means such reactions which
- are related to the depletion of ozone layer
  - study of reactions in plants
  - produce colour during reactions
  - reduce the use and production of hazardous chemicals
- 47) The presence of chlorine is indicated in a compound if its mass spectrum, show  $M^+$  and  $(M+2)^+$  peaks in the intensity ratio
- 2:1
  - 3:1
  - 1:1
  - 1:2

- 48) Infrared region lies between

- ultraviolet and radiowave
- visible and radio waves
- Visible and microwave
- UV and Visible waves

- 49) What reagent and/or reaction conditions would you choose to bring about the following conversion?



- $\text{LiAlH}_4, 2\text{H}_2\text{O}$
  - $\text{H}_2\text{O}, \text{NaOH}$
  - $\text{H}_2\text{O}, \text{H}_2\text{SO}_4$
  - PCC,  $\text{CH}_2\text{Cl}_2$
- 50) Which of the following alcohols gives the best yield of dialkyl ether on being heated with a trace of sulphuric acid?
- 1-Pentanol
  - 2-Pentanol
  - Cyclo pentanol
  - 2-Methyl-2-butanol
- 51)  $dS = 0$  for a
- Reversible process in an isolated system
  - Reversible process in a closed system

- C. Reversible process in an open system  
D. Irreversible process in an isolated system

52) Dispersion of liquid into a gas is called

- A. sol  
B. aerosol  
C. emulsion  
D. gel

53) Choose the correct statement:  
The enthalpy of mixing for perfect gas

- A.  $\Delta_{\text{mix}} H = 0$   
B.  $\Delta_{\text{mix}} H = 1$   
C.  $\Delta_{\text{mix}} H = <1$   
D.  $\Delta_{\text{mix}} H = >1$

54) Match the following:

Molecule	Point group
(I) $\text{H}_2\text{O}$	(i) $T_d$
(II) $\text{CH}_3\text{Cl}$	(ii) $D_{2h}$
(III) $\text{C}_2\text{H}_4$	(iii) $C_{3v}$
(IV) $\text{CH}_4$	(iv) $C_{2v}$

- A. (I) - (iv), (II) - (iii), (III) - (ii), (IV) - (i)  
B. (I) - (ii), (II) - (i), (III) - (iv), (IV) - (iii)  
C. (I) - (iii), (II) - (i), (III) - (iv), (IV) - (ii)  
D. (I) - (iv), (II) - (ii), (III) - (i), (IV) - (iii)

55) Choose the molecule(s) with a center of symmetry  
(I)  $\text{SF}_6$  (II)  $\text{CO}_2$  (III)  $\text{XeF}_4$  (IV)  $\text{H}_2\text{O}$

- A. I, II and III only  
B. IV only  
C. III and IV only  
D. I and IV only

56) Einstein temperature of solid,  $\theta_E$ , is equal to

- A.  $\hbar /kT$
- B.  $\hbar$
- C.  $\hbar /k$
- D.  $PV$

(where k is Boltzmann constant)

57) Match the following:

<u>List I</u>	<u>List II</u>
I) Total number of characteristic operations	(i) Symmetry element
II) Sum of diagonal elements	(ii) Identity
III) Doing nothing	(iii) Character
IV) The point, line or plane with	(iv) Order of the point group

- A. (I)-(iv), (II)-(iii), (III)-(ii), (IV)-(i)
- B. (I)-(ii), (II)-(iv), (III)-(i), (IV)-(iii)
- C. (I)-(ii), (II)-(i), (III)-(iii), (IV)-(iv)
- D. (I)-(i), (II)-(iii), (III)-(iv), (IV)-(ii)

58) The entropy is \_\_\_\_\_ if there is only one way of achieving a given total energy

- A. One
- B. Zero
- C.  $>1$
- D. Infinity

59) A reaction is thermodynamically feasible if

- A.  $\Delta_r G^\circ < 0$
- B.  $\Delta_r G^\circ > 0$
- C.  $\Delta_r G^\circ = 0$
- D.  $\Delta_r G^\circ = 1$

60) Number of orbitals in a shell with  $n=5$  (where n is the principal quantum number) is

- A. 25
- B. 5
- C. 125
- D. 3

- 61) Which one of the following statements is not true?
- A. Ice has a residual entropy of  $3.4 \text{ J K}^{-1} \text{ mol}^{-1}$
  - B. The osmotic pressure of a solution is proportional to the concentration of the solute
  - C. An ideal solution is one in which the solute obeys Henry's law
  - D. All heteronuclear diatomic molecules are nonpolar
- 62) If a system can exchange matter with the surroundings, it is called
- A. open system
  - B. closed system
  - C. isolated system
  - D. metastable system
- 63) Which one of the following statements is not true?
- A. Bosons are particles with half integral spin.
  - B. The stiffer the bond, the greater is the force constant.
  - C. Unit of pressure is pascal.
  - D. Normal value of the pH of the human blood plasma is 7.4.
- 64) Heat capacity is defined as
- A.  $C = dS/dT$
  - B.  $C = dq/dT$
  - C.  $C = dq$
  - D.  $C = RT$
- 65) The ideal gas constant, R, is equal to
- A.  $8.314 \text{ cal mol}^{-1}$
  - B.  $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
  - C.  $8.314 \text{ J } ^\circ\text{C}^{-1} \text{ mol}^{-1}$
  - D.  $2 \text{ J K}^{-1} \text{ mol}^{-1}$
- 66) Which one of the following statements is not true?
- A. Gold at the nanoscale is red.
  - B.  $C_p - C_v = nR$
  - C.  $e^-$  is a Fermion.
  - D. IR inactive vibration in  $\text{CO}_2$  is bending vibration.
- 67) Possible quantum states for a carbon atom with the configuration  $1s^2 2s^2 2p^2$
- A. 12
  - B. 6

- C. 15  
D. 9

68) Stirling's approximation is

- A.  $\ln X!$  ;  $X \ln X - X$   
B.  $\ln X!$  ;  $X \ln X$   
C.  $\ln X!$  ;  $X \ln X + X$   
D.  $\ln X!$  ;  $X$

69) Unit of partition function is

- A. dimensionless  
B.  $s^{-1}$   
C. D  
D.  $K^{-1}$

70) Boltzmann's constant,  $k$ , is equal to

- A. ideal gas constant  
B. ideal gas constant  $\times$  Avogadro's number  
C. ideal gas constant / T  
D. ideal gas constant / Avogadro's number

71) Number of IR active normal modes of  $H_2O$  molecule is

- A. three  
B. two  
C. one  
D. None of the above

72) Match the following:

<u>Acids</u>	<u>pKa (at 25°C)</u>
I) Acetic acid	(i) 3.75
II) Formic acid	(ii) 6.49
III) Chromic acid	(iii) 1.64
IV) Periodic acid	(iv) 4.76

- A. (I)-(i), (II)-(iv), (III)-(ii), (IV) - (iii)  
B. (I)-(ii), (II)-(i), (III)-(iv), (IV) - (iii)  
C. (I)-(iii), (II)-(iv), (III)-(i), (IV) - (ii)  
D. (I)-(iv), (II)-(i), (III)-(ii), (IV) - (iii)

- 73) Pick out the nuclei having spin,  $I = 1$
- (I)  $^1\text{H}$  (II)  $^2\text{D}$  (III)  $^{14}\text{N}$  (IV)  $^{19}\text{F}$
- A. (II) and (III) only  
B. (I) only  
C. (IV) only  
D. (I) and (IV) only
- 74) \_\_\_\_\_ is known as dry ice.
- A. Solid  $\text{CO}_2$   
B.  $\text{H}_2\text{O}_2$   
C. Phenol  
D.  $\text{NH}_4\text{Br}$
- 75) Choose the correct statement(s)
- (I) An ensemble is defined as a collection of identical units of a system.  
(II) Exponent is unitless.  
(III) Absorbance,  $A = \log I_0$   
(IV) In fluorescence, the spontaneous emission may persist for long periods.
- A. (I) and (II) only  
B. (III) and (IV) only  
C. (III) only  
D. (IV) only
- 76) Best catalyst for  $\text{NH}_3$  synthesis is
- A. Mo  
B. Ni  
C. Fe  
D. None of the above
- 77) The number of vibrational degrees of freedom for a nonlinear polyatomics are
- A.  $3N-6$   
B.  $3N$   
C.  $3N-5$   
D.  $3N+6$
- 78) The coordination number of a primitive cubic lattice is
- A. 4  
B. 8  
C. 6



- D. 9
- 79) Unit of molar absorption coefficient,  $\epsilon$ , is
- $s^{-1}$
  - $dm^3 mol^{-1}$
  - $dm^3 mol^{-1} cm^{-1}$
  - $kJ mol^{-1}$
- 80) The bond order of NO is
- $2 \frac{1}{2}$
  - 2
  - 1
  - 3
- 81) Pick out Boson(s) from the following:
- (I)  $^2H$  (II)  $^4He$  (III)  $^{14}N$  (IV) Photon
- All four
  - None
  - (I) only
  - (II) Only
- 82) Selection rule for rotational transition is
- $\Delta J = \pm 1$
  - $\Delta J = \pm 2$
  - $\Delta J = 0$
  - $\Delta J = \pm 3$
- 83) S branch lines arise from \_\_\_\_\_ transition (Raman spectra)
- $J \rightarrow J+1$
  - $J \rightarrow J$
  - $J \rightarrow J+2$
  - $J \rightarrow J - 1$
- 84) The root mean square velocity is
- $3kT$
  - $3kTm$
  - $(3kT/m)^{1/2}$
  - $(m/3kT)^{1/2}$

85) Spectral region of rotation of polyatomic molecules is

- A. Microwave
- B. UV
- C. Infrared
- D. Visible

86) Pick out the microwave active molecule

- A. HCl
- B. CH<sub>4</sub>
- C. H<sub>2</sub>
- D. SF<sub>6</sub>

87) Match the following:

<u>Bond</u>	<u>Bond Length (Å°)</u>
I) C – C	(i) 1.09
II) C = C	(ii) 1.20
III) C ≡ C	(iii) 1.34
IV) N ≡ N	(iv) 1.54

A. (I) – (i), (II) – (ii), (III) – (iv), (IV) – (iii)  
 B. (I) – (ii), (II) – (iii), (III) – (iv), (IV) – (i)  
 C. (I) – (iii), (II) – (iv), (III) – (i), (IV) – (ii)  
 D. (I) – (iv), (II) – (iii), (III) – (ii), (IV) – (i)

88) Pick out the polar molecule(s) from the following:

(I) HCl (II) O<sub>3</sub> (III) NH<sub>3</sub> (IV) CO<sub>2</sub>

- A. I, II and III only
- B. IV only
- C. I and II only
- D. II and IV only

89) Match the following:

<u>Region</u>	<u>Molecular Process</u>
(I) Microwave	(i) Vibration of flexible bonds
(II) Far IR	(ii) Electronic transitions
(III) IR	(iii) Rotation of small molecules
(IV) Visible & UV	(iv) Rotation of polyatomic molecule

- A. (I) – (iv), (II) – (iii), (III) – (i), (IV) – (ii)
- B. (I) – (iii), (II) – (iv), (III) – (ii), (IV) – (i)

- C. (I) – (ii), (II) – (iv), (III)- (iii), (IV) – (i)  
 D. (I) – (i), (II) – (ii), (III)- (iv), (IV) – (iii)

90) Match the following:

Vibration Type	$\bar{\nu}$ /cm <sup>-1</sup>
I) C≡C stretch	(i) 700-1250
II) C=O stretch	(ii) 1640 – 1780
III) C - C stretch, bend	(iii) 2100-2260
IV) Hydrogen bonds	(iv) 3200-3570

- A. (I) - (iii), (II) - (ii), (III) - (i), (IV) - (iv)  
 B. (I) - (iii), (II) - (iv), (III) - (ii), (IV) - (i)  
 C. (I) - (ii), (II) - (iv), (III) - (iii), (IV) - (i)  
 D. (I) - (i), (II) - (ii), (III) - (iv), (IV) - (iii)

91) Dipole moment of CCl<sub>4</sub> is

- A. Zero  
 B. 1.85  
 C. 1.08  
 D. 0.45

92) Variance is

- A. Equal to standard deviation  
 B. Average value  
 C. Square root of the standard deviation  
 D. Square of the standard deviation

93) Which one of the following statements is not true?

- A. The freezing temperature when the pressure is 1atm is called the normal freezing point.  
 B. Charge on a proton is equal to  $1.6022 \times 10^{-19}$  C.  
 C. Vibrational energy levels are equally or evenly spaced.  
 D. The conductivity of a metallic conductor increases as the temperature is raised.

94) Calculate the height of column of water that exerts same pressure as a column of mercury of 760 mm height (density of mercury = 13.6g/cm<sup>3</sup>).

- A. 1.05m  
 B. 5.25m  
 C. 10.3m  
 D. 8.3m

- 95) A balloon inside a room, where the temperature is  $27^{\circ}\text{C}$  has a volume of 2.00L. What will its volume be outdoors, where the temperature is  $-23^{\circ}\text{C}$  (Assume no change in the gas pressure).
- A. 1.20 L  
B. 1.67 L  
C. 4.80 L  
D. 2.40 L
- 96) How much heat does it take to raise the temperature of 225g water from 25.0 to  $100.0^{\circ}\text{C}$ ?
- A. 70.5 kJ  
B. 40.37 kJ  
C. 58.5 kJ  
D. 705.00 J
- 97) For the reaction  $A \rightarrow \text{products}$  a plot of  $[A]$  versus time is found to be a straight line. The order of the reaction is
- A. first  
B. second  
C. zero  
D. impossible to determine from the graph
- 98) The reaction  $2A+B \rightarrow C+2D$  is first order in A and first order in B. For this reaction
- A. rate of reaction =  $k[A]^2[B]$   
B. rate of reaction =  $k[A]^2$   
C. rate of disappearance of A = rate of disappearance of B  
D. rate of formation of C =  $-(\text{rate of disappearance of B})$
- 99) The first order reaction has a half life of 13.9 min. The rate at which the reaction proceeds when  $[A] = 0.40 \text{ M}$  is
- A.  $0.020 \text{ M min}^{-1}$   
B.  $8.0 \text{ M min}^{-1}$   
C.  $0.050 \text{ M min}^{-1}$   
D.  $0.125 \text{ M min}^{-1}$
- 100) Which of the following is most likely to lead to the complete precipitation of a metal ion as its sulphide from a saturated solution of  $\text{H}_2\text{S}$ ?
- A. Add an acid  
B. Increase the  $[\text{H}_2\text{S}]$  in the solution  
C. Raise the pH  
D. Heat the solution

- 101) A body mass of 10 mg is moving with a velocity of  $100 \text{ ms}^{-1}$ . The wavelength of the deBroglie wave associated with it would be
- A.  $6.63 \times 10^{-37} \text{ m}$
  - B.  $6.63 \times 10^{-31} \text{ m}$
  - C.  $6.63 \times 10^{-34} \text{ m}$
  - D.  $6.63 \times 10^{-35} \text{ m}$
- 102) Which of the following is used as moderator in nuclear reactors?
- A. Cadmium
  - B. Heavy water
  - C. Uranium
  - D. Boron
- 103) If  $\text{MX}_3$  is T shaped, then the lone pair around M is
- A. 2
  - B. 0
  - C. 3
  - D. 5
- 104) Which of the following is amphoteric oxide?
- A. CO
  - B.  $\text{N}_2\text{O}$
  - C.  $\text{Al}_2\text{O}_3$
  - D.  $\text{P}_4\text{O}_{10}$
- 105)  $\text{XeF}_6$  on reaction with CsF gives
- A.  $[\text{XeF}_5]^+[\text{CsF}_2]^-$
  - B.  $\text{XeF}_8$
  - C.  $[\text{XeF}_4]^{2+}[\text{CsF}_3]^{2-}$
  - D.  $\text{Cs}^+[\text{XeF}_7]^-$
- 106) The oxidation number of Pt in  $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]^-$  is
- A. +1
  - B. +2
  - C. +3
  - D. +4

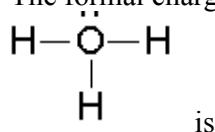
- 107) An example of a molecule with 3center–2 electron band is
- A.  $\text{XeF}_2$
  - B.  $\text{B}_2\text{H}_6$
  - C.  $\text{ICl}_2$
  - D.  $\text{BF}_4$
- 108) Which of the following gives red precipitate with  $\text{AgNO}_3$ ?
- A. KI
  - B.  $\text{K}_2\text{CrO}_4$
  - C. NaBr
  - D.  $\text{NaNO}_3$
- 109) When a substance A reacts with water, it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. A, B, C and D respectively are
- A. Na,  $\text{H}_2$ , NaOH, Zn
  - B. K,  $\text{H}_2$ , KOH, Al
  - C. Ca,  $\text{H}_2$ ,  $\text{Ca}(\text{OH})_2$ , Sn
  - D.  $\text{CaC}_2$ ,  $\text{C}_2\text{H}_2$ ,  $\text{Ca}(\text{OH})_2$ , Fe
110. If 3.22 g of  $\text{Na}_2\text{SO}_4 \cdot n\text{H}_2\text{O}$  on heating expels 1.80 g of water to give the anhydrous salt, then its molecular formula is
- A.  $\text{Na}_2\text{SO}_4 \cdot \text{H}_2\text{O}$
  - B.  $2\text{Na}_2\text{SO}_4 \cdot \text{H}_2\text{O}$
  - C.  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$
  - D.  $3\text{Na}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$
111. The order of polarity of bonds, shown by a dash is
- A.  $\text{H-Cl} > \text{H-OH} > \text{H-NH}_2$
  - B.  $\text{H-OH} > \text{H-Cl} > \text{H-NH}_2$
  - C.  $\text{H-Cl} > \text{H-NH}_2 > \text{H-OH}$
  - D.  $\text{H-OH} > \text{H-NH}_2 > \text{H-Cl}$

112. The first four ionization energies of an element are 288, 412, 650 and 3220 kJ/mol respectively. The number of valence electrons present in the element is
- 1
  - 2
  - 3
  - 4
113. The correct order of the first ionization energies of C, N, O and F is
- $C < N < O < F$
  - $F < N < O < C$
  - $O < F < N < C$
  - $C < O < N < F$
114. The common isotopes of carbon are  $^{12}\text{C}$  (98.9%) and  $^{13}\text{C}$  (1.1%). The atomic mass of naturally occurring carbon is
- 12.50 u
  - 13.00 u
  - 12.00 u
  - 12.01 u
115. The boiling points of  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$  and  $\text{H}_2\text{Se}$  are in the order
- $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se}$
  - $\text{H}_2\text{O} > \text{H}_2\text{S} < \text{H}_2\text{Se}$
  - $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se}$
  - $\text{H}_2\text{S} > \text{H}_2\text{O} > \text{H}_2\text{Se}$
116. The radii of hydrated ions is in the order
- $\text{Rb}^+ > \text{K}^+ > \text{Na}^+ > \text{Li}^+$
  - $\text{Li}^+ > \text{Na}^+ > \text{K}^+ > \text{Rb}^+$
  - $\text{Na}^+ > \text{K}^+ > \text{Rb}^+ > \text{Li}^+$
  - $\text{Rb}^+ > \text{Na}^+ > \text{K}^+ > \text{Li}^+$
117. In the graph of atomic number vs. ionization energy for the elements through Na to Ar,
- maxima occur at Mg and S
  - maxima occur at Mg and P
  - maxima occur at Na and P
  - maxima occur at Na and S

118. In the series,  $O^{2-}$ ,  $F^-$ ,  $Na^+$  and  $Mg^{2+}$ , the ionic radii varies in the order

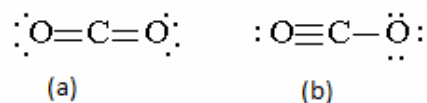
- A.  $O^{2-} > F^- > Na^+ > Mg^{2+}$
- B.  $O^{2-} < F^- > Na^+ < Mg^{2+}$
- C.  $O^{2-} > F^- < Na^+ > Mg^{2+}$
- D.  $O^{2-} = F^- = Na^+ = Mg^{2+}$

119. The formal charge on oxygen in the species



- A. -2
- B. -1
- C. +1
- D. +3

120. Both the structures, (a) and (b) of  $CO_2$  given below satisfy the octet rule.



The better structure between them and the reason for that is

- A. (a); there is no formal charge on any atom.
  - B. (a); all the electron pairs are symmetrically arranged.
  - C. (b); sum of the single and triple bond energies is greater than the sum of the two double bond energies.
  - D. (b); the two oxygens carry opposite formal charges and hence attract each other.
121. Which one of the following properties is not the characteristic of alkali metals?
- A. Low I E
  - B. Low electronegativity
  - C. Outermost  $ns^1$  electronic configuration
  - D. Low atomic volume
122. According to the VSEPR theory, the structures of  $PF_5$  and  $BrF_5$  are respectively
- A. TBP and SP
  - B. SP and TBP
  - C. TBP and TBP
  - D. SP and SP



123. The number of bond pairs and lone pairs present in the molecules, (a)  $\text{BF}_3$  and (b)  $\text{PF}_3$  are,
- A. (a) 3, 1; (b) 3,1
  - B. (a) 3, 0; (b) 3,1
  - C. (a) 1, 0; (b) 3,1
  - D. (a) 3, 0; (b) 3,0
124. The hybridisations and the geometries of  $\text{XeF}_4$  and  $\text{SF}_4$  are respectively,
- A.  $\text{sp}^3\text{d}^2$ , octahedral and  $\text{sp}^3$ , tetrahedral
  - B.  $\text{sp}^3\text{d}^2$ , octahedral and  $\text{sp}^3\text{d}$ , see-saw
  - C.  $\text{sp}^3\text{d}^2$ , square planar and  $\text{sp}^3$ , tetrahedral
  - D.  $\text{sp}^3\text{d}^2$ , square planar and  $\text{sp}^3\text{d}$ , see-saw
125. In which of the following the O-N-O bond angle is the highest?
- A.  $\text{N}_2\text{O}_4$
  - B.  $\text{NO}_2^+$
  - C.  $\text{NO}_2^-$
  - D.  $\text{NO}_3^-$
126. The order of screening effect of electrons in the inner orbitals of an atom on the outer most electrons is
- A.  $s > p > d > f$
  - B.  $s > d > p > f$
  - C.  $p > d > f > s$
  - D.  $d > f > p > s$

127. Which of the following represents the best resonance structure for  $\text{N}_2\text{O}$ ?
- A.
- B.  $\ominus \text{:}\ddot{\text{O}}\text{:} - \overset{\oplus}{\text{N}} \equiv \text{N} \text{:}$
- C.
- D.
128. Among  $\text{H}_2\text{O}$ ,  $\text{PF}_5$ ,  $\text{BrF}_5$  and  $\text{BF}_3$ , the molecules with zero dipole moment are
- A.  $\text{BrF}_5$  and  $\text{BF}_3$
- B.  $\text{PF}_5$  and  $\text{BrF}_5$
- C.  $\text{PF}_5$  and  $\text{BF}_3$
- D.  $\text{BF}_3$  and  $\text{H}_2\text{O}$
129. The strongest Bronsted base among  $\text{H}_2\text{PO}_4^-$ ,  $\text{HSO}_4^-$ ,  $\text{NO}_3^-$  and  $\text{CH}_3\text{COO}^-$  is
- A.  $\text{H}_2\text{PO}_4^-$
- B.  $\text{HSO}_4^-$
- C.  $\text{CH}_3\text{COO}^-$
- D.  $\text{NO}_3^-$
130. Among  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{NO}$ ,  $\text{NO}^+$ ,  $\text{O}_2^+$  and  $\text{O}_2^{2-}$ , the species having the same bond orders are
- A.  $\text{O}_2$ ,  $\text{NO}$ ,
- B.  $\text{N}_2$ ,  $\text{NO}^+$
- C.  $\text{N}_2$ ,  $\text{O}_2^{2-}$
- D.  $\text{NO}^+$ ,  $\text{O}_2^+$
131. Which of the following reactions of xenon compounds is not feasible?
- A.  $3\text{XeF}_4 + 6\text{H}_2\text{O} \rightarrow 2\text{Xe} + \text{XeO}_3 + 12\text{HF} + 1.5\text{O}_2$
- B.  $\text{XeO}_3 + 6\text{HF} \rightarrow \text{XeF}_6 + 3\text{H}_2\text{O}$
- C.  $2\text{XeF}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Xe} + 4\text{HF} + \text{O}_2$

- D.  $\text{XeF}_6 + \text{RbF} \rightarrow \text{Rb} [\text{XeF}_7]$
132. When  $\text{Br}_2$  reacts with hot concentrated  $\text{KOH}$ , the oxidation numbers of bromine in the products changes as
- 0 to  $-1$  and 0 to  $+3$
  - 0 to  $-1$  and 0 to  $+5$
  - 0 to  $-1$  and 0 to  $+7$
  - 0 to  $+3$
133. The most acidic and the least acidic among  $\text{P}_2\text{O}_5$ ,  $\text{As}_2\text{O}_3$ ,  $\text{Sb}_2\text{O}_3$  and  $\text{Bi}_2\text{O}_3$  are respectively,
- $\text{P}_2\text{O}_5$ ,  $\text{As}_2\text{O}_3$
  - $\text{P}_2\text{O}_5$ ,  $\text{Bi}_2\text{O}_3$
  - $\text{Bi}_2\text{O}_3$ ,  $\text{P}_2\text{O}_5$
  - $\text{Bi}_2\text{O}_3$ ,  $\text{P}_2\text{O}_5$
134. Which among the following compounds would have optical isomers?  
**I** :  $\text{cis} - [\text{Co}(\text{en})_2\text{Cl}_2]^+$ , **II** :  $\text{trans} - [\text{Co}(\text{en})_2\text{Cl}_2]^+$ , **III** :  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  and **IV** :  $[\text{Ni}(\text{CO})_2(\text{PPh}_3)_2]$ .
- Both I and II
  - both I and III
  - All the four
  - I only
135. The order of CFSEs for octahedral complexes of  $\text{Cr}(\text{III})$  with  $\Gamma^-$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$  and  $\text{CN}^-$  are in the order,
- $\text{CN}^- < \text{H}_2\text{O} < \text{NH}_3 < \Gamma^-$
  - $\text{CN}^- < \text{H}_2\text{O} < \Gamma^- < \text{NH}_3$
  - $\Gamma^- < \text{H}_2\text{O} < \text{NH}_3 < \text{CN}^-$
  - $\Gamma^- < \text{NH}_3 < \text{H}_2\text{O} < \text{CN}^-$
136. The complex  $[\text{Ma}_4\text{bc}]$  can exist as cis- and trans-isomer. Which one of them will give three isomeric products by replacing a 'a' ligand by 'c'? (a, b and c are monodentate ligands).
- cis-only
  - trans-only
  - both cis- and trans
  - none of them

137. Identify the not true statement among the following:
- $[\text{CoF}_6]^{3-}$ : octahedral and paramagnetic
  - $[\text{NiCl}_4]^{2-}$ : square planar and diamagnetic
  - $[\text{Ni}(\text{CN})_4]^{2-}$ : square planar and diamagnetic
  - $[\text{CuCl}_4]^{2-}$ : square planar and paramagnetic
138. In which of the following compounds, the formal oxidation state and coordination number of Co are, respectively,  $-1$  and  $4$ ?
- $\text{Co}_2(\text{CO})_8$
  - $\text{MeCo}(\text{CO})_4$
  - $\text{NaCo}(\text{CO})_4$
  - $\text{Co}_4(\text{CO})_{12}$
139. The increasing order of magnetic moments of I:  $[\text{Fe}(\text{CN})_6]^{4-}$ , II:  $[\text{Fe}(\text{CN})_6]^{3-}$ , III:  $[\text{CrCl}_6]^{3-}$  and IV:  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  is
- $\text{I} < \text{II} < \text{III} < \text{IV}$
  - $\text{I} < \text{II} < \text{IV} < \text{III}$
  - $\text{IV} < \text{III} < \text{I} < \text{II}$
  - $\text{II} < \text{III} < \text{I} < \text{IV}$
140. Which one of the following pairs of isomers and types of isomerism are correctly matched?
- $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$  – linkage
  - $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$  and  $[\text{Pt}(\text{NH}_3)_4][\text{CuCl}_4]$  – coordination
  - $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{SO}_4$  and  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$  – ionization
- (II) and (III)
  - (I), (II) and (III)
  - (I) and (II)
  - (I) and (III)
141. Which one of the following combinations is likely to yield a stable molecule of the type  $\text{XY}_7$ ?
- $\text{X} = \text{F}, \text{Y} = \text{I}$
  - $\text{X} = \text{Cl}, \text{Y} = \text{F}$
  - $\text{X} = \text{Br}, \text{Y} = \text{Cl}$
  - $\text{X} = \text{I}, \text{Y} = \text{F}$



142. The number of P-O-P bridges in  $P_4O_6$  and  $P_4O_{10}$  are respectively,
- A. 4, 4
  - B. 4, 6
  - C. 6, 4
  - D. 6, 6
143. Identify the isostructural pairs among the following:  $NF_3$ ,  $NO_3^-$ ,  $H_3O^+$ ,  $I_3^-$  and  $BF_3$ .
- A. [ $NF_3$ ,  $NO_3^-$ ] and [ $H_3O^+$  and  $BF_3$ ]
  - B. [ $NF_3$ ,  $H_3O^+$ ] and [ $NO_3^-$  and  $BF_3$ ]
  - C. [ $NF_3$ ,  $BF_3$ ] and [ $NO_3^-$  and  $I_3^-$ ]
  - D. [ $NF_3$ ,  $NO_3^-$ ] and [ $BF_3$  and  $I_3^-$ ]
144. For a transition metal ion having eight electrons in its d-orbitals, the spin-only magnetic moment (in B M) will be
- A.  $\sqrt{18}$
  - B.  $\sqrt{8}$
  - C.  $\sqrt{9}$
  - D.  $\sqrt{10}$
145. The  $E^0$  values for  $Ag^+/Ag$ ,  $K^+/K$ ,  $Mg^{2+}/Mg$  and  $Cr^{3+}/Cr$  are 0.80V, -2.93V, -2.37V and -0.74 V respectively. The reducing power of the metals is in the order
- A.  $Ag > Cr > Mg > K$
  - B.  $K > Mg > Cr > Ag$
  - C.  $Ag > Cr > K > Mg$
  - D.  $Cr > Ag > Mg > K$
146. Metallic copper and iron have respectively FCC and BCC structures at room temperature. The coordination numbers of Cu and Fe in their structures are
- A. Cu : 12 and Fe : 8
  - B. Cu : 8 and Fe : 12
  - C. Cu : 6 and Fe : 8
  - D. Cu : 6 and Fe : 6

147. Which of the following are peroxy acids of sulphur?
- A.  $\text{H}_2\text{SO}_5$  and  $\text{H}_2\text{S}_2\text{O}_8$
  - B.  $\text{H}_2\text{SO}_5$  and  $\text{H}_2\text{S}_2\text{O}_7$
  - C.  $\text{H}_2\text{S}_2\text{O}_8$  and  $\text{H}_2\text{S}_2\text{O}_7$
  - D.  $\text{H}_2\text{S}_2\text{O}_6$  and  $\text{H}_2\text{S}_2\text{O}_7$
148. The atomicity and the total number of bonds in elemental white phosphorus molecule are, respectively
- A. 4 and 6
  - B. 6 and 4
  - C. 4 and 4
  - D. 6 and 6
149. Which one of the following does not obey 18-electron rule?
- A.  $[\text{Fe}(\text{CO})_5]$
  - B.  $[\text{Cr}(\text{CO})_5]^{2-}$
  - C.  $[\text{Mn}(\text{CO})_6]^+$
  - D.  $[\text{V}(\text{CO})_6]$
150. If the CFSE for an octahedral complex  $\text{ML}_6$  is  $20000 \text{ cm}^{-1}$ , then the CFSE of the tetrahedral complex,  $\text{ML}_4$  will be approximately
- A.  $20000 \text{ cm}^{-1}$
  - B.  $15000 \text{ cm}^{-1}$
  - C.  $9000 \text{ cm}^{-1}$
  - D.  $45000 \text{ cm}^{-1}$

\*\*\*