

JUPEB

Chemistry

Past questions

Paper Type: **Objective (PT. 1-4)**

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SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. The reproducibility or repeatability of a measurement is termed _____

- A. Accuracy
- B. Precision
- C. Range
- D. Confidence Interval

2. The alpha (α -) scattering experiment is synonymous with _____

- A. J. J. Thomson
- B. Ernest Rutherford
- C. James Chadwick
- D. Henry Mosley

3. According to Brønsted-Lowry, an acid is a/an _____

- A. proton acceptor.
- B. proton donor.
- C. electron acceptor.
- D. electron donor.

4. Isotopes of hydrogen differ from one another in _____

- A. atomic number.
- B. number of protons.
- C. number of electrons.
- D. number of neutrons.

5. A solution of known concentration is termed a _____

- A. standard solution.
- B. unsaturated solution.
- C. saturated solution.
- D. supersaturated solution.

6. Which of the following is the reason why CCl_4 is non-polar?

- A. The polar bonds cancel each other.
- B. The molecule is non-linear.
- C. The molecule is covalent.

D. Small electronegativity difference between C and Cl.

7. In what period of the periodic table can the element with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$ be found?

- A. 4
- B. 3
- C. 2
- D. 1

8. When a proton and an electron beam are subjected to the same strong electric field, the electron beam is deflected at a greater angle than the proton beam because _____

- A. electron beam has a negative charge while proton beam has a positive charge
- B. an electron is heavier than a proton
- C. the electron is lighter than the proton
- D. an electron has more electrical energy than a proton

9. $X_g^+ \rightarrow X_g^{2+} + e^-$. The energy utilized in the equation is typical of _____

- A. 1st electron affinity
- B. 1st ionization energy
- C. 2nd ionization energy
- D. 2nd electron affinity

10. Which of these electronic configurations belong to an element in period 3 of the periodic table?

- A. $[\text{Ne}] 3s^1$
- B. $1s^2$
- C. $[\text{He}] 2s^2 2p^3$
- D. $[\text{Ar}] 4s^2 3d^3$

11. 0.200mol of a hydrocarbon undergo complete combustion to give 35.2g of carbon dioxide and 14.4g of water as the only products. What is the molecular formula of the hydrocarbon? (C = 12.0, H = 1.0, O = 16.0)

- A. C_2H_4
- B. C_2H_6

C. C_4H_4

D. C_4H_8

12. Which of the following is the best evidence of the presence of ionic bonding in an unknown substance? The substance conducts electricity _____

A. in the solid state and in aqueous solution.

B. when molten and in aqueous solution.

C. in the solid state and when molten.

D. when molten but not in the solid state.

13. Decomposition reaction has a half-life that does not depend on the initial concentration of the reactant. What is the order of the reaction?

A. zero order

B. first order

C. second order

D. pseudo-first order

14. Fucoserratene, a hydrocarbon usually identified as the sexual pheromone of the brown seaweed *Fucus serratus* has an empirical formula of C_2H_3 . If the experimentally determined molecular weight of this substance is 108 g/mol, the molecular formula of fucoserratene is _____

A. C_4H_6

B. C_6H_9

C. C_8H_{12}

D. $C_{10}H_{15}$

15. Atoms of elements principally go into bonding in order to achieve _____

A. stability

B. covalency

C. electrovalency

D. attraction

16. In a chemical reaction, the heat change at constant pressure is referred to as _____

A. Entropy

- B. Enthalpy
- C. Gibbs free energy
- D. Bond energy

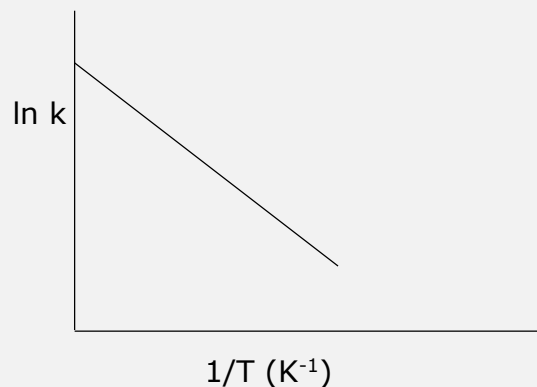
17. In a given chemical reaction, the exponent(s) of the concentration terms with respect to the reactant species as determined experimentally is/are called _____

- A. Molecularity
- B. Order of reaction
- C. Elementary step
- D. Rate law

18. Which of the following is used as detector for radiations from nuclear processes?

- A. Cyclotron
- B. Particle accelerator
- C. Geiger counter
- D. Electron volts system

19. The following represents a plot obtained from an experiment to graphically determine the activation energy of a reaction.



Which of the following is a measure of the slope?

- A. $\frac{Ea}{R}$
- B. $-\frac{Ea}{R}$
- C. $\frac{Ea}{RT}$
- D. $-\frac{R}{Ea}$

20. Equal numbers of moles of He (g), Ar(g), and Ne(g) are placed in a glass vessel at room temperature. If the vessel has a pinhole-sized leak, which of the following will be true regarding the relative values of the partial pressures of the gases remaining in the vessel after some of the gas mixture has effused?

- A. $P_{He} > P_{Ne} > P_{Ar}$
- B. $P_{Ar} > P_{Ne} > P_{He}$
- C. $P_{Ne} > P_{Ar} > P_{He}$

D. $P_{\text{Ar}} > P_{\text{He}} > P_{\text{Ne}}$

21. Sodium is not suitable as a sacrificial anode to prevent corrosion of underground iron pipes because _____

- A. It would react with groundwater quickly.
- B. It has less standard electrode potential than that of iron.
- C. It will form an oxide coating that prevents further oxidation.
- D. It is not a transition metal.

22. A solid which contains more than one type of bonding is _____

- A. Ice.
- B. Diamond.
- C. Iron.
- D. Calcium oxide.

23. What is the coordination number of the coordination compound $\text{Pt}(\text{NH}_3)_2\text{C}_2\text{O}_4$?

- A. 3
- B. 4

C. 6

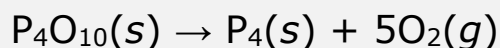
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24. All the following will exhibit common ion effect except _____

- A. Addition of sodium acetate to a solution of acetic acid.
- B. Addition of sodium chromate to a saturated solution of lead chromate.
- C. Addition of hydrochloric acid to a saturated solution of silver chloride.
- D. Addition of hydrochloric acid to a saturated solution of silver nitrate.

25. When white phosphorus burns in air, it produces phosphorus (V) oxide. $\text{P}_4(\text{s}) + 5\text{O}_2(\text{g}) \rightarrow \text{P}_4\text{O}_{10}(\text{s})$; $\Delta H = -3010 \text{ kJ}$

What is ΔH for the following equation?



- A. +3010 kJ
- B. -3010 kJ
- C. +602 kJ

D. -602 kJ

26. Water gas is a mixture of two gases namely _____

A. CO and NO

B. CO₂ and H₂

C. CO and H₂

D. CO and H₂O

27. Which of the following is/are true of alkali metals

(I) They have the largest size in their respective period

(II) They have weak metallic bonding

(III) They are soft and they have low melting point

A. I only

B. II only

C. I, II and III

D. I and III only

28. The following statements are properties of group 17 elements except _____

A. They have a valency of -1

B. They belong to the p-block of the periodic table

C. They are all non-metals

D. They are all reducing agents with Fluorine having the highest reducing power

29. Transition elements usually exhibit variable oxidation states mainly because _____

A. they are metals

B. they are employed as catalysts

C. their d-electrons are involved in bonding

D. they have high melting and boiling point

30. The highest oxidation number of iodine is _____

A. -1

B. 0

C. +5

D. +7

31. Which of the following does not exhibit allotropy?

- A. Sulphur
- B. Phosphorus
- C. Carbon
- D. Nitrogen

32. Which of the following inter-halogen compound below does not exist?

- A. ClBr_3
- B. IF_3
- C. ClF_5
- D. ICl_3

33. Why is the ionic radius of a chloride ion larger than the ionic radius of a sodium ion?

- A. A chloride ion has one more occupied electron shell than a sodium ion
- B. chlorine has a higher proton number than sodium
- C. Ionic radius increases regularly across the third period
- D. Sodium is a metal, chloride is a non-metal

34. Which group of particles is in order of increasing size?

- A. N, O, F
- B. N^{3-} , O^{2-} , F^-
- C. Na^+ , Mg^{2+} , Al^{3+}
- D. Na^+ , Ne, F^-

35. Diagonal relationships exist between the following pairs except _____

- A. Be and Al
- B. B and Si
- C. Li and Mg
- D. Mg and Al

36. Chlorine react with methane in the presence of sunlight through a process known as free radical reaction, which equation represents the propagation step?

- A. $\text{CH}_4 + \text{Cl}\bullet \rightarrow \text{CH}_3\bullet + \text{HCl}$
- B. $\text{CH}_3\bullet + \text{CH}_3\bullet \rightarrow \text{C}_2\text{H}_6$
- C. $\text{CH}_3\bullet + \text{Cl}\bullet \rightarrow \text{CH}_3\text{Cl}$
- D. $\text{Cl}_2 \rightarrow 2\text{Cl}\bullet$

37. What is the product of the reaction between bromine and ethene gas?

- A. 2-bromoethane
- B. Bromoethane
- C. 1, 2-dibromoethane
- D. 1, 1-dibromoethane

38. The IUPAC name of the compound $\text{CH}\equiv\text{C}-\text{CH}_2-\text{CH}_2-\text{COOH}$ is _____

- A. 1-pentyn-4-oic acid
- B. pentyn-1-oic acid
- C. 5-pentyn-1-oic acid
- D. pent-4-yn-1-oic acid

39. A family of organic compounds which follows a regular structural pattern such that each successive member differs from the preceding one by a $-\text{CH}_2-$ group is termed _____

- A. Homologue
- B. Organic series
- C. Homologous series
- D. Isotopic series

40. The hybridization of the carbon atom in ethyne is _____

- A. sp_4
- B. sp
- C. sp_3
- D. sp_2

41. The following types of isomerism are found in aliphatic alkanes EXCEPT _____

- A. Geometric isomerism
- B. Position isomerism
- C. Chain isomerism
- D. Structural isomerism

42. How many isomers are possible for a hydrocarbon with molecular formula C_4H_8 ?

- A. two
- B. three
- C. four
- D. six

43. What compounds are formed when sodium metal reacts with propanol?

- A. Sodium propoxide and hydrogen
- B. Sodium oxide and propene
- C. Sodium hydroxide and propene
- D. Sodium methoxide and water

44. Which of the following chemical equations represents the reaction of group 1 metal hydrides (MH) with water?

- A. $MH + H_2O \rightarrow MO + 3H$
- B. $MH + H_2O \rightarrow MOH + H_2$
- C. $MH + H_2O \rightarrow MOH + 2H$
- D. $MH + H_2O \rightarrow M + OH + H_2$

45. What are the geometric shape and oxidation number of the cobalt in the complex ion, $[Co(NH_3)_4(H_2O)_2]^{3+}$?

- A. Tetrahedral, +3
- B. Octahedral, -3
- C. Octahedral, +3
- D. Tetrahedral, -3

46. What type of reaction occurs between propene and concentrated hydrogen bromide

solution to produce a mixture of 2-bromopropane and 1-bromopropane?

- A. Addition
- B. Substitution
- C. Elimination
- D. Displacement

47. How many counter ions are there in the coordination compound $[Co(NH_3)_5Cl]Cl_2$?

- A. 1
- B. 2
- C. 5
- D. 6

48. The product of oxidation of secondary alcohol with $K_2Cr_2O_7 / H^+$ is a/an _____

- A. carboxylic acid
- B. ester
- C. aldehyde
- D. a ketone

49. The following are reducing sugars EXCEPT _____

- A. Fructose
- B. Sucrose
- C. Maltose
- D. Cellulose

50. How many isomeric forms are there for the molecular formula $C_3H_6Br_2$?

- A 4
- B 1
- C 2
- D 3

CHECK YOUR **ANSWERS**

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JUPEB CHEMISTRY PAST QUESTIONS (PT. 3)

SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. Which of the following statements is incorrect?

- A. An atom is electrically neutral
- B. The size of a cation is smaller than that of the corresponding atom
- C. The size of an anion is bigger than that of the corresponding atom
- D. An atom and its ion have an unequal number of protons

2. Bronsted-Lowry base is _____

- A. an electron pair acceptor
- B. a proton acceptor
- C. an electron pair donor
- D. a proton donor

3. Which states that no two electron in an atom can have the same set of quantum numbers?

- A. Hund's rule
- B. Aufbau's principle
- C. de Broglie hypothesis
- D. Pauli's exclusion principle

4. Calculate the relative molecular mass of a gaseous compound if 13.15g of the compound occupies 4.80dm³ at STP.

- A. 61
- B. 34
- C. 24
- D. 29

5. Which of the following species has the same electronic configuration as Al³⁺ ion?

- A. F⁻
- B. Cl⁻
- C. S²⁻
- D. O⁻

6. What is the volume of oxygen required to burn completely 45cm^3 of methane?

- A. 400cm^3
- B. 180cm^3
- C. 90cm^3
- D. 22.5cm^3

7. Which of the following is TRUE regarding a precipitation reaction?

- A. both products must be soluble in water
- B. At least one of the products will be insoluble in water
- C. At least one of the reactants must be insoluble in water
- D. Spectator ion forms insoluble salts

8. Arrange the following in order of increasing boiling point: CH_4 , HCN , CaO

- A. $\text{CH}_4 < \text{HCN} < \text{CaO}$
- B. $\text{HCN} < \text{CH}_4 < \text{CaO}$
- C. $\text{CH}_4 < \text{CaO} < \text{HCN}$
- D. $\text{CaO} < \text{CH}_4 < \text{HCN}$

9. The electronegativity value of Si and H are 1.8 and 2.1 respectively. What type of bond exist within SiH_4 ?

- A. Ionic
- B. Polar covalent
- C. Coordinate covalent
- D. Non-polar bond

10. When an atom is oxidized, its oxidation number _____

- A. decreases, as electrons are gained
- B. decreases, as electrons are lost
- C. increases, as electrons are gained
- D. increases, as electrons are lost

11. What mass of carbon dioxide is formed when 60.0g of carbon is burned in 750.0g of oxygen? [C = 12, O = 16]

- A. 60.0g
- B. 160.0g
- C. 220.0g
- D. 1031g

12. A solution capable of resisting change in pH upon the small addition of acid or base is _____

- A. an aqueous solution
- B. a colloidal solution
- C. a buffer solution
- D. a super saturated solution

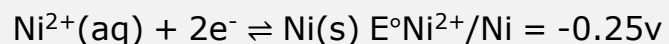
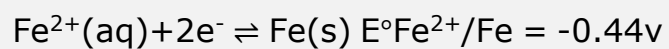
13. What is the percentage by mass of carbon present in 6.0g of a hydrocarbon which burns completely in air to produce 11.0g of carbon dioxide? [C=12, O=16]

- A. 25%
- B. 33%
- C. 50%
- D. 75%

14. In which of the following species is sp^2 hybrid orbitals NOT involved?

- A. PCl_3
- B. BF_3
- C. C_2H_4
- D. CO_2

15. Calculate the standard e.m.f in volts of a cell that uses the following half-cell reactions:



- A. 0.18
- B. 0.69
- C. 0.11
- D. 0.19

16. What is the oxidation number of oxygen in Na_2O_2 ?

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

17. If the enthalpy of a given reaction is -215 kJ mol^{-1} and the entropy change of the reaction is $15.2 \text{ J mol}^{-1}K^{-1}$ at 30°C , then the reaction will _____

- A. not be spontaneous
- B. be spontaneous
- C. be irreversible
- D. be at equilibrium

18. The temperature and pressure at which the three phases of pure water coexist respectively are _____

- A. 273 K and 760 mmHg
- B. 298 K and 1 atm
- C. 0.01°C and 4.5 mmHg
- D. 0.273°C and 0.1 mmHg

19. The p^H of buffer solution depends upon the concentration of _____

- A. conjugate acid
- B. conjugate base
- C. salt
- D. conjugate acid and base

20. What is the mole fraction of oxygen gas in a mixture containing 32.0g oxygen gas, 32.0g of methane gas and 32.0g of sulphur (IV) oxide? [C=12, O=16, H=1, S=32]

- A. 0.143
- B. 0.286
- C. 0.333

D. 0.572

21. At 17°C, a sample of hydrogen gas occupies 125cm³. What will the volume be at 100°C, if the pressure remains constant?

- A. 21cm³
- B. 91cm³
- C. 161cm³
- D. 735cm³

22. Why is the first ionization energy of phosphorus greater than that of silicon?

- A. The outer electron in phosphorus is paired
- B. The atomic radius of a phosphorus atom is greater
- C. A phosphorus atom has one more proton in its nucleus
- D. The outer electron in phosphorus is more shielded

23. Which of the following pairs exhibit the most similar chemical properties?

- A. Li and Mg
- B. Ca and Zn
- C. B and C
- D. N and O

24. Which of the following metals is not a first row transition element?

- A. V
- B. Cd
- C. Cr
- D. Mn

25. The following ions have noble gas electronic configuration EXCEPT _____

- A. Sr^{2+}
- B. Rb^+
- C. I^-
- D. Sn^{2+}

26. Which of the following compound is the anion most polarized?

- A. LiF
- B. LiI

- C. LiCl
- D. LiBr

27. The colligative properties of a solution are affected by _____

- A. nature of the solute
- B. concentration of solute molecule
- C. amount of liquid
- D. surface area of solute

28. What is the coordination number and oxidation state of the central atom in $[\text{NiCl}_2(\text{en})_2]$?

- A. 6, 2
- B. 6, 0
- C. 4, 2
- D. 4, 4

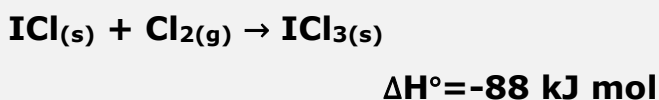
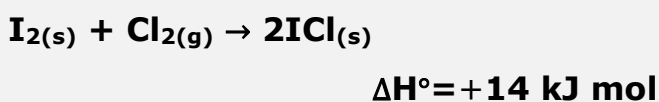
29. Excess soil acidity caused by acid rain can be neutralized by _____

- A. adding more fertilizers
- B. adding molten cryolite
- C. adding brime
- D. adding quick lime

30. Which of the following is an s-block element?

- A. Cs
- B. Ar
- C. Cl
- D. He

31. Use the following data to determine the standard enthalpy change formulation for solid ICl_3 .



- A. -60 kJ mol
- B. -74 kJ mol
- C. -81 kJ mol
- D. -162 kJ mol

32. The oxide of nitrogen used as a mild anaesthetic for surgery is _____

- A. nitrogen (IV) oxide
- B. dinitrogen (I) oxide
- C. dinitrogen tetroxide
- D. nitrogen (II) oxide

33. Which of these reactions in equilibrium is unaffected by a change in pressure?

- A. $2\text{O}_{3(g)} \rightleftharpoons 3\text{O}_{2(g)}$
- B. $\text{PCl}_{5(g)} \rightleftharpoons \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$
- C. $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$
- D. $2\text{HI}_{(g)} \rightleftharpoons \text{H}_{2(g)} + \text{I}_{2(g)}$

34. The trihalides of phosphorus react with water to form one of the following acids.

- A. H_3PO_4
- B. $\text{H}_5\text{P}_3\text{O}_{10}$
- C. H_3PO_3
- D. $\text{H}_4\text{P}_2\text{O}_6$

35. Which of the following hydrogen halides is the most acidic: HF, HCl, HBr, HI?

- A. HF
- B. HI
- C. HBr
- D. HCl

36. The IUPAC name for $[\text{FeF}_4(\text{H}_2\text{O}_2)]^-$ is _____

- A. diaquatetrafluoroiron (III) ion
- B. diaquatetrafluoroferrate (III) ion
- C. diaquatetrafluoroiron (III)
- D. diaquatetrafluoroferrate (III)

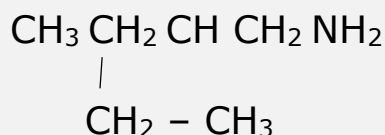
37. Reaction between a hydrazine and a carbonxyl compound yields a _____

- A. hydrazone
- B. diazonium salt
- C. benzaldehyde
- D. phenyl hydrazine

38. Which of the following is tertiary amine?

- A. $\text{CH}_3\text{CH}_2\text{NH}_2$
- B. $\text{CH}_3\text{CH}_2\text{NHCH}_3$
- C. $(\text{CH}_3\text{CH}_2)_2\text{NCH}_3$
- D. $\text{CH}(\text{NH}_2)_3$

39. Name the following organic compound.



- A. 3-ethylbutanamines
- B. 3-methylamine pentane
- C. 2-ethylbutanamine

D. 3-ethyl-4-butamine

40. Heterolytic bond fission results in the formation of positively charged carbon species known as _____

- A. free radicals
- B. carbanions
- C. carbonium ions
- D. carbenes

41. The following statements are true of an electrolytic cell EXCEPT _____

- A. it converts electrical energy to chemical energy
- B. a porous partition is not needed
- C. cathode is negative electrode while anode is positive electrode
- D. electrodes are in separate compartment

42. The oxidation of $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$ with potassium tetraoxomanganate (VII) gives _____

- A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- B. $\text{CH}_3\text{CH}_2\text{COOH}$
- C. $\text{CH}_3\text{CH}_2\text{COCH}_3$
- D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHOH}$

43. Hydrogenation of vegetable oils to produce margarine is an example of _____

- A. addition reaction
- B. substitution reaction
- C. elimination reaction
- D. redox reaction

44. The enzyme suitable for the conversion of starch to maltose is _____

- A. maltase
- B. zymase
- C. lipase
- D. diastase

45. $\text{CH}_3\text{CH}_2\text{CHCHCH}_2\text{CH}_3$ does not undergo _____

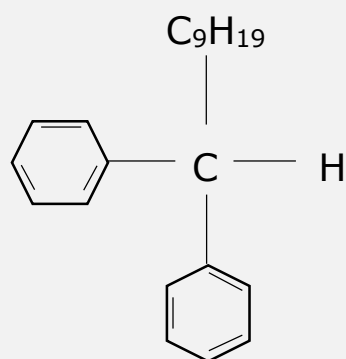
- A. addition reaction
- B. substitution reaction
- C. combustion reaction

D. polymerization reaction

46. The compound with molecular formula C_5H_{12} has _____

- A. 2 isomers
- B. 3 isomers
- C. 4 isomers
- D. 5 isomers

47. Consider the structure



What electronic effect is likely to be observed?

- A. Inductive effect
- B. Electromeric effect
- C. Steric effect
- D. Tautomeric effect

48. The following compounds $\text{C}_6\text{H}_{13}\text{NH}_2$, $\text{C}_3\text{H}_7\text{NH}_2$, $\text{CH}_3\text{CH}_2\text{NH}_2$,

and CH_3NHCH_3 are all related as

- A. chain isomers
- B. homologues
- C. functional group isomers
- D. primary amines

49. Which of the following reactions is suitable for the synthesis of alkenes?

- A. Dehydration of primary alcohols
- B. Hydrolysis of primary alcohols
- C. Reduction of primary alcohols
- D. Oxidation of primary alcohols

50. Branched chain isomers have the following properties when compared with their linear isomers.

- A. Low boiling point, low melting point and high density
- B. Lower boiling point, high melting point and lower density
- C. Higher boiling point, high melting point and low density
- D. Lower boiling point, low melting point and low density

D. Lower boiling point, low melting point and low density

CHECK YOUR ANSWERS

*Would you like to get or confirm the **correct answer(s)** to any or all of these questions?*

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SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. Precision in measurement is _____

- A. agreement between replicate measurements
- B. closeness of measurement to the true value
- C. estimated in terms of absolute error
- D. difference between measured value and true value

2. Which of the following is NOT an assumption of Bohr's model of atom?

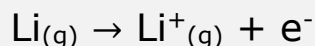
- A. Emission spectra of atom are continuous
- B. Electron moves in allowed orbits around the nucleus

- C. The electron does not emit energy when in the orbits
- D. Transitions between orbits are accompanied by emission or absorption of radiation

3. The following factors influence ionization energies EXCEPT _____

- A. shielding effects of inner electrons
- B. magnitude of the nuclear charge
- C. shape of the orbital containing the valence electron
- D. distance of outer electrons from the nucleus

4. The energy associated with the process below is called _____



- A. electron affinity
- B. ionization energy
- C. lattice energy
- D. binding energy

5. The condensed electronic configuration of Zn^{2+} ($Z=30$) is _____

- A. $[Ar] 4s^2 3d^{10}$
- B. $[Ar] 4s^2 3d^8$
- C. $[Ar] 4s^1 3d^{10}$
- D. $[Ar] 4s^0 3d^{10}$

6. All the following are attributes of light EXCEPT _____

- A. it consists of perpendicular electric and magnetic fields
- B. its frequency is directly proportional to its wavelength
- C. it is both a photon and a wave
- D. its speed in vacuum is fastest

7. Which of the following is NOT true of electromagnetic spectrum?

- A. Visible light makes up a small proportion of the spectrum
- B. The wavelength of ultraviolet radiation is greater than that of the infrared radiation
- C. Gamma rays have shorter wavelength

D. Microwaves are not visible

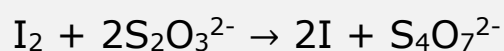
8. A base is a proton acceptor, according to _____

- A. Arrhenius concept
- B. Bronsted-Lowry concept
- C. Lewis concept
- D. Dalton's concept

9. A bottle of concentrated hydrochloric acid solution has been reading "37.8% HCl by mass". Calculate the molarity of this solution if it has a density of 1.1919 g cm^{-3} . [$H=1.0$, $Cl=35.5$]

- A. 11.3 M
- B. 14.5 M
- C. 12.0 M
- D. 12.3 M

10. State the change in oxidation number of sulphur in the redox reaction below:



- A. -2 to -4

- B. +2 to +3
- C. -4 to -2
- D. +3 to +2

11. What is the percent of carbon in the glutamic acid, $C_5H_8NO_4$?

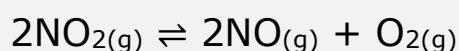
[C=12.01, H=1.01, N=14.0, O=16.00]

- A. 8.22
- B. 24.3
- C. 41.1
- D. 48.2

12. Which of the following elements exhibits diagonal relationship with aluminium?

- A. beryllium
- B. silicon
- C. carbon
- D. germanium

13. Nitrogen dioxide decomposes on heating according to the following equation.



When 4 mol of nitrogen dioxide was put into 1 dm³ container and heated to a constant temperature, the equilibrium mixture contained 0.8 mol of oxygen. What is the numerical value of equilibrium constant, K_c , at the temperature of the experiment?

- A. $\frac{0.8^2 \times 0.8}{4^2}$
- B. $\frac{1.6 \times 0.8}{2.4^2}$
- C. $\frac{1.6^2 \times 0.8}{4^2}$
- D. $\frac{1.6^2 \times 0.8}{2.4^2}$

14. In which of the following reactions is the change in entropy positive?

- A. $2Ag^+_{(aq)} + Zn_{(s)} \rightleftharpoons Zn^{2+}_{(aq)} + 2Ag_{(s)}$
- B. $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
- C. $2HF_{(g)} \rightleftharpoons H_{2(g)} + F_{2(g)}$
- D. $H_2O_{(s)} \rightleftharpoons H_2O_{(l)}$

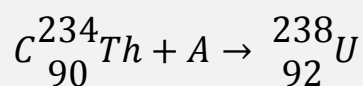
15. A system in which only energy is transferred between the system and the surrounding is _____

- A. open system
- B. isolated system
- C. closed system
- D. adiabatic

16. Which of these orbitals is the most stable?

- A. 3d
- B. 4p
- C. 5p
- D. 5d

17. Identify the species A in the radioactive reaction represented by the equation below:



- A. ${}_{1}^{0}n$
- B. ${}_{0}^{1}e$
- C. ${}_{1}^{1}\gamma$
- D. ${}_{2}^{4}\text{He}$

18. Arrange the following elements in order of decreasing reducing power: Na, Rb, K, Cs.

- A. Cs > K > Rb > Na

- B. Na > K > Cs > Rb
- C. Cs > Rb > K > Na
- D. Cs > K > Na > Rb

19. Hydride of the halogens with the highest stability to heat is _____

- A. HCl
- B. HBr
- C. HF
- D. HI

20. Hydrocarbons which react with ammonical copper (I) chloride solution conform to the general molecular formula _____

- A. C_nH_n
- B. C_nH_{2n}
- C. $\text{C}_n\text{H}_{2n+2}$
- D. $\text{C}_n\text{H}_{2n-2}$

21. In the coordination compounds, $[\text{Co}(\text{NH}_3)_6][\text{FeCl}_4]_x$, if the primary valences of both Co and Fe are both +3, what is x?

- A. 2

- B. 1
- C. 3
- D. 5

22. Which of the following is TRUE about sodium chloride in the solid state?

- A. Its ions are linked by metallic bonds
- B. It exists as aggregate of ions
- C. It conducts electricity
- D. It exists as discrete molecules

23. A method of preventing corrosion that involves coating steel with zinc metal is called _____

- A. painting
- B. enamelling
- C. electroplating
- D. galvanizing

24. What type of radioactive decay produces a daughter nucleus with a higher atomic number?

- A. α

- B. β^-
- C. γ
- D. β^+

25. For a reaction that is second order with respect to a reactant, A, how many times does the rate increase as [A] increases by a factor of 2?

- A. 1 time
- B. 2 times
- C. 3 times
- D. 4 times

26. What is the number of atoms present in 21.6g of Ag? [Ag=108 gmol⁻¹, N_A=6.023 × 10²³ mol⁻¹]

- A. 0.2×10^{24}
- B. 1.204×10^{23}
- C. 6.02×10^{22}
- D. 1.08×10^{23}

27. Transition metal atoms without unpaired electrons are said to be _____

- A. diamagnetic

- B. paramagnetic
- C. ferromagnetic
- D. anti-ferromagnetic

28. Strontium is an element in Group 2 of the Periodic Table. Which of the following statements about strontium is NOT correct?

- A. Its first ionization energy is lower than that of calcium
- B. Its atomic radius is smaller than magnesium
- C. It has two electrons in its outermost energy level
- D. It forms a chloride with the formula SrCl_2

29. Why is the melting point of diamond much higher than that of graphite?

- A. Diamond consists of covalent bonds extending in all directions
- B. The structural layers of graphite are too far apart
- C. Diamond has a higher density than graphite

D. Graphite is partially soluble in water

30. The oxidation state of Au in $\text{K}[\text{Au}(\text{OH})_4]$ is _____

- A. +1
- B. +2
- C. +3
- D. +4

31. Which of the following is NOT true of a catalyst?

- A. Catalysts will decrease the activation energy of a reaction
- B. Catalysts will be influenced by the pH of the substance
- C. Catalysts do not change the thermodynamics of the reaction
- D. Catalysts cause a change in the equilibrium constant of the reaction

32. Which of the following will always produce a spontaneous reaction?

- A. Positive ΔH and a positive ΔS

- B. Positive ΔH and a negative ΔS
- C. Negative ΔH and a positive ΔS
- D. Negative ΔH and a negative ΔS

33. In the electrolysis of brine (concentrated NaCl) using mercury as the cathode, the components produced and resulting solution are _____, _____, and _____ respectively.

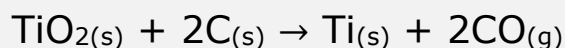
- A. H_2 , Cl_2 , and basic
- B. Na, O_2 , and neutral
- C. H_2 , O_2 , and basic
- D. Na, Cl_2 , and neutral

34. The IUPAC name of $K_2[PtCl_6]$ is _____

- A. Potassium hexachloroplatinate (II)
- B. Potassium hexachloroplatinate (IV)
- C. Platinum hexachloroplatinate (I)
- D. Potassium hexachloroplatinum (II)

35. Given that the standard enthalpy changes of formation of $TiO_{2(s)}$ and $CO_{(g)}$ are -940 kJ mol^{-1} and -110 kJ mol^{-1} respectively,

what is the standard enthalpy (kJ mol) change of the reaction?



- A. -830
- B. -720
- C. +720
- D. +830

36. The reaction $C_{12}H_{20}O_{10} + 2H_2O \rightarrow 2C_6H_{12}O_6$ represents _____

- A. polymerization of glucose
- B. hydrolysis of carbohydrate
- C. fermentation of sugar
- D. dehydration of starch

37. The shape and bond angle of the sp^2 hybridized orbital are _____

- A. tetrahedral and 109.5°
- B. trigonal and 120°
- C. trigonal and 180°
- D. linear and 180°

38. Calculate the volume of oxygen evolved at 285K and 0.91

$\times 10^5 \text{ Nm}^{-2}$ when a current of 2.5A is passed through acidified water for 1.5mins. [Molar volume of a gas = 22.4 dm^3 , standard pressure = $1.01 \times 10^5 \text{ Nm}^{-2}$, 1Faraday = 96500C]

- A. 12.34 cm^3
- B. 23.12 cm^3
- C. 15.13 cm^3
- D. 9.13 cm^3

39. Which of the following groups of compound forms a layer of silver when reacted with silver troxonitrate (V) in the presence of excess ammonia?

- A. Alkanols
- B. Alkanals
- C. Alkanones
- D. Alkanoic acids

40. Which of the following compounds is NOT a functional group isomer of $\text{CH}_2\text{OHCH}_2\text{CHO}$

- A. $\text{CH}_2=\text{COHCH}_2\text{OH}$
- B. $\text{CH}_3\text{OCH}_2\text{CHO}$

C. $\text{CH}_3\text{CHOHCHO}$

D. $\text{CH}_3\text{COCH}_2\text{OH}$

41. Which of the following is the final product from the reaction of ethyne with hydrogen bromide?

- A. $\text{CH}_3 - \text{CHBr}_2$
- B. $\text{CH}_2\text{Br} - \text{CH}_2\text{Br}$
- C. $\text{CH}_3 - \text{CH}_3$
- D. $\text{CH}_2 = \text{CHBr}$

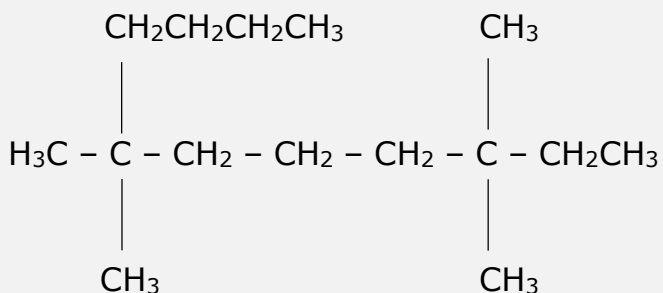
42. The IUPAC name for $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHClCH}_3$ is _____

- A. 2-Chloropentane
- B. 2-Chloropropane
- C. 4-Chlorohexane
- D. 4-Chloropentane

43. In Benedict's test, a positive test is indicated by a colour change from _____

- A. brick red to blue
- B. brown to purple
- C. blue to red
- D. purple colour change

44. The IUPAC name for the compound below is _____



- A. 5,5,9,9-tetramethylundecane
- B. 3,3,7,7-tetramethylundecane
- C. 2,6,6-trimethyl-2-n-butyloctane
- D. 3,3,7-trimethyl-7-n-butyloctane

45. Given below are sets of homologous series, identify the set that contains a carboxyl group.

- A. alkanes, alkenes, alkynes
- B. alcohols, carboxylic acids, ethers
- C. aldehydes, ketones, amines
- D. carboxylic acids, aldehydes, ketones

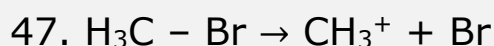
46. There is free rotation about the carbons of ethane but not that of ethene. This is due to the fact that _____

- A. the carbons in ethane are round

B. there are only four hydrogen atoms in ethane

C. the carbons in ethane are smaller than those of ethene

D. the carbons in ethane are linked by double bonds



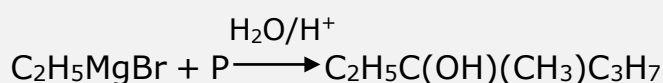
The above equation shows _____

- A. substitution reaction
- B. homolytic fission
- C. heterolytic fission
- D. electrophilic reaction

48. Which group of compounds produce yellow crystals of CHI_3 in the presence of I_2/NaOH ?

- A. Alkane
- B. Alkanone
- C. Carboxylic acid
- D. Ester

49. Identify P in the reaction



- A. $\text{C}_3\text{H}_7\text{CHO}$

- B. C_3H_7COCl
- C. $C_3H_7COCH_3$
- D. $C_2H_5COC_2H_5$

50. An element with an atomic number of 35 is _____ block element.

- A. s-block
- B. p-block
- C. d-block
- D. f-block

CHECK YOUR ANSWERS

*Would you like to get or confirm the **correct answer(s)** to any or all of these questions?*

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JUPEB CHEMISTRY PAST QUESTIONS (PT. 1)

SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. A normal body temperature is 37°C , $K_w = 2.4 \times 10^{-14}$. Calculate $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ for the body fluid at this temperature.

- A. $[\text{H}_3\text{O}^+] = [\text{OH}^-] = 2.5 \times 10^{-7}$
- B. $[\text{H}_3\text{O}^+] = [\text{OH}^-] = 1.5 \times 10^{-8}$
- C. $[\text{H}_3\text{O}^+] = [\text{OH}^-] = 1.5 \times 10^{-6}$
- D. $[\text{H}_3\text{O}^+] = [\text{OH}^-] = 1.5 \times 10^{-7}$

2. Atoms of elements in a group on the Periodic Table have similar chemical properties. This similarity is most closely related to the atoms'.

- A. number of principal energy levels
- B. number of valence electrons
- C. atomic numbers
- D. atomic masses

3. How many atoms of Cu are present in 35.4 g of Cu? [Cu = 63.5 g mol^{-1}]

- A. 1.08×10^{24} atoms of Cu
- B. 3.27×10^{23} atoms of Cu
- C. 6.02×10^{23} atoms of Cu
- D. 1.20×10^{22} atoms of Cu

4. How would you prepare 250cm^3 of 0.25M aqueous solution of NaCl? [Na = 23 g mol^{-1} ; Cl = 35.5 g mol^{-1}]

- A. Add 3.66g NaCl to 250cm^3 of distilled water
- B. Weigh 3.66g NaCl into 250ml flask and add distilled water up to the mark
- C. Add 14.60g NaCl to 250cm^3 of distilled water
- D. Weigh 14.60g NaCl into 250ml flask and add distilled water up to the mark

5. What is the shape of PCl_3 ?

- A. Trigonal planar
- B. Trigonal pyramidal

C. Tetrahedral

D. V-shaped (bent)

6. Uranium -233 ($^{233}\text{U}_{92}$) decays by α - emission. What is the decay product?

A. $^{229}\text{Th}_{90}$

B. $^{231}\text{Th}_{90}$

C. $^{231}\text{Ac}_{91}$

D. $^{233}\text{Ac}_{91}$

7. Arrange the following ions in order of decreasing charge density Ca^{2+} , Mg^{2+} , Al^{3+} and Ba^{2+}

A. $\text{Al}^{3+} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{Ba}^{2+}$

B. $\text{Ba}^{2+} > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{Al}^{3+}$

C. $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Ca}^{2+} < \text{Ba}^{2+}$

D. $\text{Mg}^{2+} > \text{Al}^{3+} > \text{Ba}^{2+} > \text{Ca}^{2+}$

8. Which of the following statements explain why caesium has a lower melting point than sodium?

A. Sodium is a more electropositive metal

B. Sodium has higher ionization energy

C. Sodium has a stronger metallic bond

D. Caesium has a larger atomic radius

9. Transition metals can form complex ions because _____

A. they have paired electrons in the d subshell

B. they have unpaired electrons in the d subshell

C. they have empty d orbitals

D. they have small charge/size ratio

10. How many equivalent hybrid orbitals are there in Sp^2 -hybridised carbon?

A. four

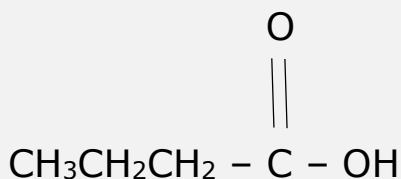
B. two

C. three

D. one

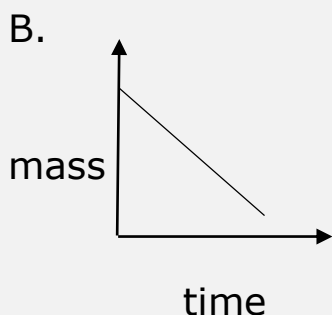
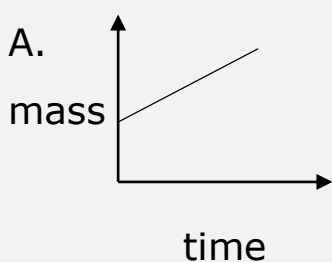
11. When common names are used for acids, the underlined

carbon atom in the molecule shown would be designated as the _____ C atom.

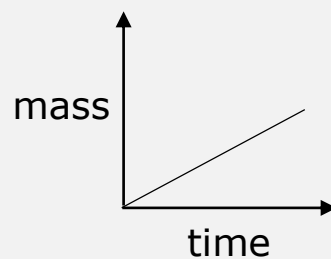


- A. gamma
- B. alpha
- C. delta
- D. beta

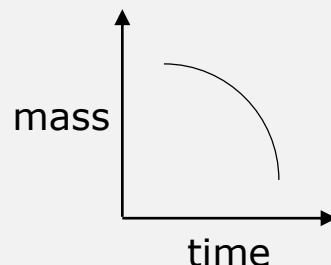
12. Purification of a strip of impure copper metal in aqueous CuSO_4 was carried out using a steady current. Which graph shows the change in mass of the cathode with time?



C.



D.



13. Which gas closely approaches ideal behaviour at room temperature and pressure?

- A. helium
- B. carbon dioxide
- C. ammonia
- D. oxygen

14. A sample of a brown gas, a major air pollutant, is found to contain 2.34g N and 5.34g O. Determine the empirical formula for this substance. [N = 14, O = 16]

- A. NO_2
- B. NO

C. N₂O

D. N₂O₃

15. Why does the rate of a gaseous reaction increase when the pressure is increased at a constant temperature?

A. More particles have energy that exceeds the activation energy.

B. The particles have more space in which to move.

C. The particles move faster.

D. There are more frequent collisions between particles.

16. Why is gaseous nitrogen less reactive than gaseous fluorine?

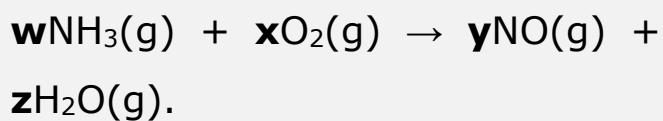
A. The boiling point of nitrogen is lower than that of fluorine.

B. The relative molecular mass of nitrogen is lower than that of fluorine.

C. The atomic radius of nitrogen is greater than that of fluorine.

D. The bond strength in the molecule is greater in nitrogen than in fluorine.

17. The first stage in the manufacture of nitric acid is the oxidation of ammonia by oxygen.



What values for w, x, y and z are needed to balance the equation?

A. 4, 5, 4 and 6

B. 4, 6, 4 and 5

C. 5, 6, 5 and 4

D. 6, 5, 6 and 4

18. The reaction of chlorine with methane is carried out in the presence of light. What is the function of the light?

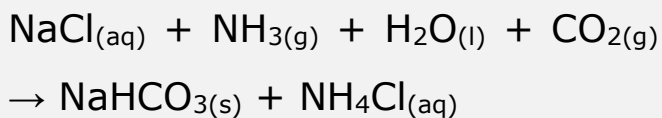
A. to break the C - H bonds in methane

B. to break up the chlorine molecules into atoms

C. to break up the chlorine molecules into ions

D. to heat up the mixture

19. In the Solvay process,



What volume of carbon dioxide (at s.t.p) is required to produce 1.00 kg of sodium hydrogencarbonate? (1 mole of gas at s.t.p occupies 22.4 dm^3) [Na = 23, Cl = 35.5, C = 12, O = 16, H = 1, N = 14]

- A. 250 dm^3
- B. 762 dm^3
- C. 267 dm^3
- D. 462 dm^3

20. Which group of particles is in order of increasing size?

- A. N, O, F
- B. N^{3-} , O^{2-} , F^-
- C. Na^+ , Mg^{2+} , Al^{3+}
- D. Na^+ , Ne, F^-

21. River water in a chalky agricultural area may contain Ca^{2+} , Mg^{2+} , CO_3^{2-} , HCO_3^- , Cl^- , NO_3^- ions. In a waterworks, such water is treated by adding a calculated quantity of calcium hydroxide.

What will be precipitated following the addition of calcium hydroxide?

- A. CaCl_2
- B. CaCO_3
- C. $\text{Ca}(\text{NO}_3)_2$
- D. $\text{Mg}(\text{NO}_3)_2$

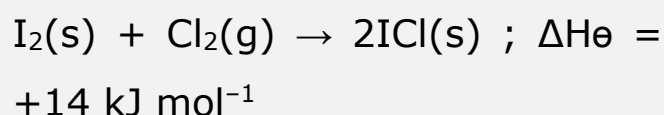
22. The electronic configuration of the Fe^{3+} ion is _____

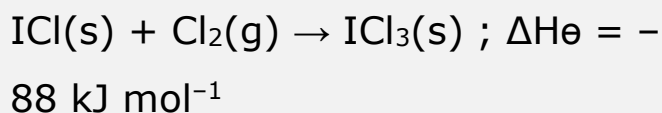
- A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$
- B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
- C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
- D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

23. An element with an atomic number of 35 is _____ block element.

- A. s-block
- B. p-block
- C. d-block
- D. f-block

24. Iodine trichloride, ICl_3 , is made by reacting iodine with chlorine.

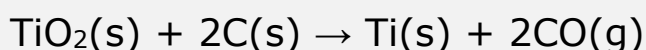




By using the data above, what is the enthalpy change of the formation for solid iodine trichloride?

- A. -162 kJ mol^{-1}
- B. -81 kJ mol^{-1}
- C. -74 kJ mol^{-1}
- D. -60 kJ mol^{-1}

25. The standard enthalpy changes of formation of $\text{TiO}_2(\text{s})$ and $\text{CO}(\text{g})$ are -940 kJ mol^{-1} and -110 kJ mol^{-1} respectively.



What is the standard enthalpy change of this reaction?

- A. -830 kJ mol^{-1}
- B. -720 kJ mol^{-1}
- C. $+720 \text{ kJ mol}^{-1}$
- D. $+830 \text{ kJ mol}^{-1}$

26. The standard enthalpy changes of formation of HCl and HI are -93 kJ mol^{-1} and $+25 \text{ kJ mol}^{-1}$ respectively. Which statement is most important in explaining this difference?

- A. The bond energy of Cl_2 is smaller than the bond energy of I_2 .
- B. The activation energy for the H_2 / Cl_2 reaction is much less than that for the H_2 / I_2 reaction.
- C. The bond energy of I_2 is smaller than the bond energy of Cl_2 .
- D. The bond energy of HI is smaller than the bond energy of HCl .

27. What is the catalyst used in the Contact process?

- A. Pd
- B. Pt
- C. Fe_2O_3
- D. V_2O_5

28. The main purpose of adding cryolite to the ore (bauxite) during the preparation of aluminium metal by electrolysis is _____

- A. minimizes the release of oxygen at the graphite anode
- B. reduce the melting point of the bauxite
- C. increase the melting point of the bauxite
- D. enable the aluminium discharge at the anode

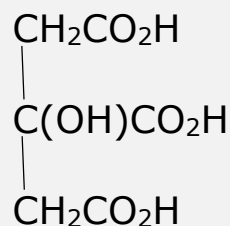
29. What type of bond needs to be broken for magnesium oxide to melt?

- A. Co-ordinate
- B. covalent
- C. ionic
- D. metallic

30. A substance which contains the following elements by mass: C, 17.8%; H, 1.5%; Cl, 52.6%; F, 28.1% has molecular mass of 135. Determine the molecular formula.

- A. C_2H_2FCl
- B. $C_2H_2F_2Cl$
- C. $C_2H_2F_2Cl_2$
- D. C_2HFCl_3

31. How many chiral centres does the compound below possess?



- A. 0
- B. 1
- C. 2
- D. 3

32. 0.200 mol of a hydrocarbon undergo complete combustion to give 35.2g of carbon dioxide and 14.4g of water as the only products. What is the molecular formula of the hydrocarbon?

- A. C_2H_4
- B. C_2H_6
- C. C_4H_4
- D. C_4H_8

33. One of the original postulates of Dalton's Atomic Theory is:

A. An atom reacts to attain electronic configuration of the noble gas closest to it.

B. When atoms of different elements react to form chemical compound, the atoms are combined in simple whole number ratio.

C. The isotopes of an element are in whole number ratio.

D. Atoms of different elements differ in terms of number of protons in their nuclei.

34. The ions in a mass spectrophotometer are separated based on their mass : charge ratio by the _____

- A. ion source
- B. mass analyzer
- C. deflector
- D. detector

35. Which of the following terms accurately describes the energy associated with the process:



A. electron affinity

B. binding energy

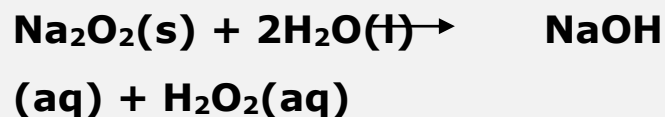
C. ionization energy

D. electronegativity

36. If the activation energy in the forward direction of an elementary step is 52 kJ and the activation energy in the reverse direction is 74 kJ, what is the energy of reaction ΔE for this step?

- A. 22 kJ
- B. -22 kJ
- C. 52 kJ
- D. -52 kJ

37. Sodium peroxide dissolves in water in accordance with the following reaction:



The pH of the solution after reaction will be _____

- A. 7-8
- B. 6-7

C. < 2

D. > 10

38. Gunpowder is a mixture of saltpetre, sulphur and wood charcoal in the ratio of 6:1:1 by mass. The mixture burns with explosion because it produces a large volume of gases. Saltpetre in the mixture acts as _____

A. modifier

B. reducing agent

C. oxidising agent

D. Fuel

39. The oxidation state of Au in $K[Au(OH)_4]$ is _____

A. +1

B. +2

C. +3

D. +4

40. The most common type of chemical reaction which alkanes undergo is _____

A. substitution

B. addition

C. condensation

D. elimination.

41. The boiling point of water is higher than that of methanol because _____

A. water is oxide while methanol is an alcohol

B. inter molecular forces in water are stronger than those in methanol

C. water is an inorganic compound while methanol is organic

D. water is an ionic compound while methanol is covalent

42. In the Rutherford scattering experiment, Rutherford bombarded a thin piece of gold foil with a beam of _____.

A. electrons

B. neutrons

C. protons

D. alpha particles

43. When azimuthal quantum number ($l = 2$), what set of orbitals is designated?

- A. p
- B. d
- C. f
- D. g

44. Sodium hydroxide is an Arrhenius base because it contains _____.

- A. Na^+
- B. OH^-
- C. NaOH
- D. Na

45. The standard state of an element or compound is determined at a pressure of and a temperature of _____.

- A. 760 mmHg, 0°C
- B. 1 atm, 273°C
- C. 760 mmHg, 0K
- D. 1 atm, 298K

46. Which of the following is a state function?

- A. enthalpy
- B. work
- C. heat
- D. power

47. The method that cannot be used for removing permanent hardness of water is _____.

- A. adding sodium carbonate
- B. boiling
- C. adding caustic soda
- D. adding slaked lime

48. In which of the following characteristics does hydrogen resemble halogens?

- A. Hydrogen is the lightest
- B. Hydrogen forms ionic hydrides with alkali metals
- C. Hydrogen atom contains one electron each
- D. Hydrogen has three isotopes

49. Which alkali metal react directly with Nitrogen to form nitride?

- A. Na
- B. K
- C. Rb
- D. Li

50. The isomerism which exists between CH_3CHCl_2 and $\text{CH}_2\text{ClCH}_2\text{Cl}$ is _____

- A. chain isomerism
- B. functional group isomerism
- C. positional isomerism
- D. metamerism

~~DISCLAIMER~~

These are **not** JUPEB expo questions for this year, but past questions of previous years.

You are advised to study these past questions and know their **correct answers** as well as how the answer to each question was gotten to be well-prepared for your JUPEB exam.

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