Chemistry Pre-entrance exam 2016/2024

Time Allowed: 2:00

* Indicates required question

1. Email *

2. 1. What current must be past through a solution of AlCl3 for 1.19 hours to produce 40g of solid Al? * 1 point

Mark only one oval.

- 10.5 amps
- 100. amps
- 50.0 amps
- 75.3 amps

3. 2. A process in which hair and fat missed by the machines are removed from the hide with a plastic tool or dull knife. * 1 point

Mark only one oval.

- Deliming
- Hair removal
- Soaking
- Scudding

4. 3. Which type of pesticide are nonpolar and lipophilic * 1 point

Mark only one oval.

- Carbamates
- Pyrethroids
- Organochlorines
- Organophosphates

5. 4. _____an inorganic, non-metallic solid prepared by the action of heat and subsequent cooling * 1 point

Mark only one oval.

- Cement
- Leather
- Paper and Pulp
- Ceramic

6. 5. Which pollutant gas is used as refrigerants, solvents and plastic foam-blowing agents. * 1 point

Mark only one oval.

- Carbon monoxide
- Chlorofluorocarbons (CFCs)
- PCBs (polychlorinated biphenyls)
- Sulphur dioxide

7. 6. The result of ozone hole is * 1 point

Mark only one oval.

- Acid rain
- Global warming
- The UV radiations the earth
- Greenhouse effect

8. 7. Which type of glass is commonly known as Pyrex * 1 point

Mark only one oval.

- Soda-lime glass
- Borosilicate glass
- Quartz glass
- ordinary glass

9. 8. What is the cell potential of the following cell: * 1 point

Zn(s) + 2H^+(aq) -> Zn^2+ (aq) + H2 (g) Eo = 0.76 V

When the [Zn^2+] = 1.0 M; PH2 = 1atm, and the pH in the cathode is 5.2?

Mark only one oval.

- 1.80 V
- 0.45 V
- 1.32 V
- 0.90 V

10. 9. How long would it take to electroplate 28.3g of silver at a constant current of 2.0 amps from a solution of silver nitrate? * 1 point

Mark only one oval.

- 844 min
- 105 min
- 211 min
- 53 min

11. 10.Which one of the following are Well-known uses of ceramics * 1 point

Mark only one oval.

- tiles on space
- kitchen tiles
- dental replacements
- electrical insulators

12. 11. _____Indicates the permissible level of a toxic pollutant in the atmosphere to which a healthy individual can be exposed during an 8-hour day without adverse effects * 1 point

Mark only one oval.

- Biological Oxygen Demand (BOD
- Dissolved Oxygen (DO)
- Sink
- Threshold Limit Value (TLV)

13. 12. Calculate the standard cell potential of the following reaction: * 1 point

Cd(s) + MnO2 (s) + 4H^+(aq) + -> Cd^2+(aq) + Mn2+ (aq) + 2H2O (l)

Given:

MnO2 (s) + 4H+ (aq) + 2e- -> Mn2+ (aq) + 2H2O(l) Eo = 1.23 V

Cd2+ (aq) + 2 e- -> Cd (s) Eo = -0.40 V

Mark only one oval.

- -1.63 V
- -0.83 V
- 0.83 V
- 1.63 V

14. 13 . Zn→Zn^2+ + 2e− Eo=0.762V * 1 point

Cu→Cu^2+ + 2e− Eo=−0.340V

Zn^2+ + Cu→ Zn + Cu^2+

What is Eo cell? Is reaction 3 spontaneous?

Mark only one oval.

- 1.1V, spontaneous
- −1.1V, spontaneous
- 1.1V, nonspontaneous
- −1.1V, nonspontaneous

15. 14. It is the most widely used method for making pulp from all types of trees. * 1 point

Mark only one oval.

- Sulphite Process
- Kraft Process
- Mechanical pulping
- Crusting

16. 15. Consider the following electrolytic cell: * 1 point

Ni + Fe^2+ → Ni^2+ + Fe $E^\circ = -0.21V$
What happens at the anode in the electrolytic cell?

Mark only one oval.

- Nickel is oxidized
- Nickel is reduced
- Iron is reduced
- Iron is oxidized

17. 16. Toward which pole do electrons travel in a galvanic cell? * 1 point

Mark only one oval.

- Towards the negative pole
- Electrons do not travel; only the protons travel
- Towards the anode
- Towards the cathode

18. 17. Which of the following differences between galvanic cells and electrolytic cells is false? * 1 point

Mark only one oval.

- Electrolytic cells have oxidation take place at the cathode
- Electrolytic cells have a positive Gibb's free energy
- Electrolytic cells are non-spontaneous
- Electrolytic cells have negative voltages

19. 18. What is true about the current flow in a galvanic cell? * 1 point

Mark only one oval.

- It flows in the direction of electron flow
- Galvanic cells do not have a current
- It travels from cathode to anode
- It travels from anode to cathode

20. 19. In a third order reaction with two reactants, if you triple the concentration of one of the reactants, the rate increases by a factor of 3. What happens to the rate of the reaction if the concentration of the second reactant is halved? * 1 point

Mark only one oval.

- It increases by a factor of 4.
- It decreases by a factor of 4.
- It doubles.
- It is halved.

21. 20. Given the following. What is the rate law for the reaction A + 2B → C * 1 point

[A](M)	[B] (M)	Rate (M/s)
0.1	0.02	0.005
0.2	0.02	0.02
0.1	0.01	0.0025

Mark only one oval.

- Rate = k [A]^2[B]
- Rate = k [A]
- Rate = k [B]
- Rate = k [A] [B]2

22. 21. Consider the following balanced equation. * 1 point

Al2O3 + 6NaOH + 12HF ------- -2Na3AlF6 + 9H2O

The rate law for this reaction is rate=k[Al2O3]^2[NaOH].
What is the rate constant for this reaction if the reaction proceeds at an initial rate of 0.005Ms when all of the reactants have initial concentrations of 0.02M?

Mark only one oval.

- k=0.25
- k=625
- k=12.5
- k=31,250

23. 22. For the following reaction $H_2 + 2ICl \rightarrow 2HCl + I_2$ describe the rate of consumption of H_2 in regards to the consumption of ICl and the production of I_2 * 1 point

Mark only one oval.

- Same as ICl, same as I_2
- Same as ICl, half of I_2
- Half of ICl, half of I_2
- Half of ICl, same as I_2

24. 23. For the reaction NO_2 (g) + CO (g) -> NO (g) + CO_2 (g), the reaction was experimentally determined to be Rate = k[NO_2]^2. If the reaction has the following mechanism, what is the rate limiting step, and why? * 1 point

Step 1: 2 NO_2 -> NO_3 + NO (slow)

Step 2: NO_3 + CO -> NO_2 + CO_2 (fast)

Mark only one oval.

- Step 1 is limiting because the reaction can not go faster than its slowest step.
- Step 2 is limiting because the NO_3 intermediate has to be formed before the reaction can occur.
- Step 1 is limiting because the NO_2 is a reactant.
- Step 2 is limiting because the fast step determines how quickly the reaction can occur.

25. 24. The rate constant for a second-order reaction is 0.15 M-1s-1. If the initial concentration of the reactant is 0.30 M, how long does it take for the concentration to decrease to 0.15 M? * 1 point

Mark only one oval.

- 253 second
- 44.4 second
- 88.8 seconds
- 22.2 seconds

26. 25. A compound decomposes by a first-order process. If 25.0% of the compound decomposes in 60 minutes, the half-life of the compound is? * 1 point

Mark only one oval.

- 145 minutes
- 120 minutes
- 198 minutes
- 180 minutes

27. 26. Consider the following reaction: * 1 point

A+2B→2C

The equilibrium constant, Keq, is 0.367.

In a reaction flask, you have a solution containing [A]=0.332M, [B]=0.0200M, and [C]=0.332M. Will the reaction proceed forward (to the right), or backwards (to the left) reach equilibrium ?

Mark only one oval.

- The reaction will proceed both to the right and two the left, but at equal rates
- The reaction will proceed to the left
- The reaction will proceed to the right
- None of the available answers

28. 27. What is the definition of the triple point? * 1 point

Mark only one oval.

- The condensation line of the phase diagram
- The state where liquid and gas cannot be differentiated
- The state where solid, liquid, and gas coexist in equilibrium
- The point in which temperature change has no effect on the substance

29. 28. Which of the following can be used in a buffer solution? * 1 point

Mark only one oval.

- HCl and HNO3
- HNO3 and KNO3
- NaHCO3 and K2CO3
- NaOH and KOH

30. 29. Which of the following solutions has the greatest buffering capacity? * 1 point

Mark only one oval.

- 3M Rubidium Hydroxide
- 1M Acetic Acid
- 4M Nitric Acid
- 2M Formic Acid

31. 30. According to Le Chatelier's principle, which of the following occurs when you compress a system containing at least one gas species? * 1 point

Mark only one oval.

- shifts to favor the side with less moles of gas
- shifts to favor the side with more moles of gas
- remains at equilibrium
- not enough information to determine

32. 31. Which of the following stresses would lead the exothermic reaction below to shift to the right? * 1 point

Mark only one oval.

- Decreasing the volume
- Increasing the temperature
- Increasing [C]
- Increasing [A]

33. 32. Consider the following isotope of thorium :A=232 Z=90 Th What is the identity of the product following three alpha decay reactions? * 1 point

Mark only one oval.

- Pa A=232 Z=91
- Rn A=224 Z=86
- Ra A=228 Z=88
- Po A=220 Z=84

34. 32. At what pH does the equivalence point lie for a strong-acid / strong-base titration? 1 point

Mark only one oval.

- Slightly acidic
- 7
- Slightly basic
- It is impossible to determine

35. 33. Which of the following will cause an equilibrium shift in an exothermic reaction towards the products? * 1 point

I. Decreasing the temperature

II. Evaporating the product

III. Adding a catalyst

Mark only one oval.

- I, II, and III only
- I and II only
- I only
- III only

36. 34. Given the following equation (2A+B --> 3C). Which of the following correctly displays the rate of the reaction? * 1 point

I. -Δ[A]/2Δt

II. Δ[B]/Δt

III. Δ[C]/3Δt

Mark only one oval.

- II only
- I, II, and III
- II and III only
- I and III only

37. 35. Determine the Ecell for the following reaction at 25 C: * 1 point

Zn (s) + 2 VO2+ (aq) + 4 H+ -> 2 VO2+ (aq) + Zn2+(aq) + 2 H2O (l)

Given that:

VO2+ (aq) + 2 H^+(aq) + e- -> VO2+(aq) + H2O (l) Eo =1V

Zn2+ (aq) + 2 e--> Zn (s) Eo = -0.76 V

and [VO^2+] = 2.0 M; [H^+] = 0.50 M; [VO^2+] = 1.0 x 10^-2M; [Zn^2+] = 1.0 x 10-1M

Mark only one oval.

- 3.71 V
- 2.41 V
- 1.76 V
- 1.89 V

38. 36. The difference in the atomic radii of fluorine and lithium is most similar to the difference in the atomic radii of which pair of elements? * 1 point

Mark only one oval.

- Cs and Bi
- As and Se
- Na and Cl
- Fe and Br

39. 37. Why does fluorine have a smaller atomic radius than carbon? * 1 point

Mark only one oval.

- Halogens have a larger atomic radius than carbon
- Fluorine is farther down the group than carbon
- Fluorine is more electronegative than carbon
- Fluorine has more charged particles attracting the electron cloud to the nucleus

40. 38. A large number of molecules begin moving very fast, rarely bumping into one another, and taking up the entire space available to them. As the temperature drops and the kinetic energy of the particles decreases, the particles move more slowly and run into each other more often. They eventually form a lattice structure, only slightly moving. What is this process called? * 1 point

Mark only one oval.

- Sublimination, then freezing
- Decrease in temperature
- Vaporization, then condensation
- Condensation then freezing.

41. 39. Molecule A has twice the mass of molecule B. A sample of each molecule is released into separate, identical containers. Which compound will have a higher rate of diffusion? * 1 point

Mark only one oval.

- Molecule A would have a faster initial rate; both molecules would reach an equal final rate
- Molecule B
- Molecule A
- They will have identical rates of diffusion

42. 40. If a container holds 1mol of hydrogen, 2.5mol of helium, and 2mol of oxygen at a total pressure of 4atm, what is the partial pressure of the oxygen gas? * 1 point

Mark only one oval.

- 8.00atm
- 2.76atm
- 1.45atm
- 4.63atm

43. 41. Which of the following is not an assumption of the kinetic molecular theory of gases? * 1 point

Mark only one oval.

- Gas particles do not experience attractions/repulsions to other particles
- Gas particles are in random, continuous motion
- The kinetic energy of gas particles are different for all gases at a certain temperature
- Collisions between gas particles are elastic

44. 42. What volume of chlorine gas at 45.3oC is needed to react with 14.2g of sodium to form NaCl at 1.72atm? * 1 point

Mark only one oval.

- 0.22L
- 4.7L
- 9.49L
- 0.05L

45. 43. Which of the following compounds is a Lewis acid: HCl, AlCl3, NH3, H2SO4? * 1 point

Mark only one oval.

- NH3
- AlCl3
- HCl
- H2SO4

46. 44. A chemist mixes 50.0mL of a 1.0M NaOH solution with 50.0mL of a 1.0M Ba(OH)2 solution. Assuming the two solutions are additive, what is the pH of the resulting solution? * 1 point

Mark only one oval.

- 10.90
- 12.75
- 13.82
- 12.17

47. 45. Which of the following describes an isotope to 13C? * 1 point

Mark only one oval.

- A carbon with 4 protons, 9 neutrons
- A carbon with 6 protons, 6 neutrons
- A carbon with 6 protons, 7 neutrons
- A carbon atom with 7 protons, 6 neutrons

48. 46. What is the common name for the polymer polytetrafluoroethylene (PTFE)? * 1 point

Mark only one oval.

- A) Nylon
- B) Kevlar
- C) Teflon
- D) Bakelite

49. 47. Sodium will react with oxygen and form an ionic compound. Which of the following is false concerning this interaction? * 1 point

Mark only one oval.

- In this compound, oxygen is the anion while the two sodium atoms are defined as cations
- Sodium has a higher electronegativity than oxygen, causing it to give its electron to oxygen
- Both oxygen and the two sodiums are given stable octets by creating the ionic compound
- The ionic compound has an overall neutral charge

50. 48. What is the equilibrium constant for a reaction written in reverse if the forward reaction has constant K? * 1 point

Mark only one oval.

- 1/K
- 2K
- 4K
- K/2

51. 49. What is the hybridization of the molecular bonds and molecular geometry of NH3? * 1 point

Mark only one oval.

- sp3 hybridization and trigonal pyramidal geometry
- sp2 hybridization and trigonal pyramidal geometry
- sp3 hybridization and trigonal planar geometry
- sp2 hybridization and trigonal planar geometry

52. 50. If an electron falls from the energy level of n = 5 to the ground state of n = 1, what is most likely to occur? * 1 point

Mark only one oval.

- The electron changes its spin direction
- A neutron is transformed into a proton
- A photon is emitted
- A photon is absorbed

53. 51. Which compound has both ionic and covalent bonds? * 1 point

Mark only one oval.

- O2
- NH4+
- NaNO3
- CH4CH3CH3OH

54. 52. Which of the following best explains effective nuclear charge (Zeff)? * 1 point

Mark only one oval.

- An electrostatic attraction between valence electrons and the nucleus
- The charge of an electron
- The charge of any nucleon
- The atomic mass of an element

55. 53. Which polymer is used in making non-stick coating for cookware? * 1 point

Mark only one oval.

- A) PVC
- B) Teflon (PTFE)
- C) PET
- D) Polypropylene

56. 54. Which group of elements can be predicted to have the lowest second ionization energy? * 1 point

Mark only one oval.

- Group I
- Group VII
- Group VIII
- Group II

57. 55. Hydrogen bonding can occur between which two molecules? * 1 point

Mark only one oval.

- Methanol and methane
- Methane and water
- Methanol and water
- Water and hydrogen gas

58. 56. What is the electron configuration for Co3+? * 1 point

Mark only one oval.

- [Ar]4s^2 3d^7
- [Ar]4s^1 3d^6
- [Ar]3d^6
- [Ar]4s^1 3d^5

59. 57. When oil and vinegar salad dressing is allowed to stand at room temperature, two distinct phases are observed. The main explanation for this phenomenon is the difference in _____ of the two phases. * 1 point

Mark only one oval.

- solubility
- polarity
- density
- buoyancy

60. 58. An ideal gas takes up 60L at 2 atm. If the gas is compressed to 30L, what will the new pressure be? * 1 point

Mark only one oval.

- 1atm
- 4atm
- 0.5atm
- 2atm

61. 59. Ammonia is created according to the balanced equation below. * 1 point

$3H_2+N_2 \rightarrow 2NH_3$

The reaction is allowed to take place in a rigid container. Eight moles of hydrogen gas are mixed with two moles of nitrogen gas. The initial pressure exerted on the container is 5atm.

Assuming the reaction runs to completion, what will the pressure exerted on the vessel be after the reaction takes place?

Mark only one oval.

- 6atm
- 3atm
- 5atm
- 0.5atm

62. 60. If the activation energy of a forward reaction is greater than the activation energy of a reverse reaction, what must be true of the reaction? * 1 point

Mark only one oval.

- It is non-spontaneous
- It is endothermic
- It is exothermic
- It is spontaneous

63. 61. An organic compound A reacts with sodium metal and forms B. On heating with conc. H2SO4, A gives diethyl ether. What are A and B? * 1 point

Mark only one oval.

- a) C4H9OH and C4H9ONa
- b) CH3OH and CH3ONa
- c) C2H5OH and C2H5ONa
- d) C3H7OH and CH3ONa

64. 62. What is the difference between the reaction quotient and the equilibrium constant? * 1 point

Mark only one oval.

- The equilibrium constant is valid only at equilibrium, and the reaction quotient can be calculated at any given moment in the reaction.
- The reaction quotient is equivalent to the rate law.
- The reaction quotient is valid only at equilibrium, and the equilibrium constant can be calculated at any given moment in the reaction.
- There is no difference between the two

65. 63. Why do the concentrations of pure liquids and solids not appear in the equilibrium constant expression? * 1 point

Mark only one oval.

- They are not present in the mixture at equilibrium.
- They are completely consumed before the reaction reaches equilibrium.
- Their concentrations change too quickly to be accounted for.
- Their concentrations don't change over the course of the reaction.

66. 64. If the equilibrium constant lies farther to the right, this indicates that the reaction _____. * 1 point

Mark only one oval.

- is more complete
- does not have a bearing on the reaction
- is less complete
- includes a catalyst

67. 65. You have a solution of weak base with unknown concentration. What would be a good acid with which to titrate the weakly alkaline solution, in order to determine its concentration? * 1 point

Mark only one oval.

- Citric acid
- Sodium hydroxide
- Hydrofluoric acid
- Nitric acid

68. 66. Which catalyst is used in the Haber process for the production of ammonia? * 1 point

Mark only one oval.

- A) Nickel
- B) Platinum
- C) Iron
- D) Vanadium oxide

69. 67. The largest dipole moment will be seen in which of the following molecules? 1 point

Mark only one oval.

- HCl
- CH3OH
- CH4
- HF

70. 68. What is the character of the bonds in a molecule of ammonium? 1 point

Mark only one oval.

- 2 polar covalent bonds, 2 ionic bonds
- 3 polar covalent bonds, one coordinate covalent bond
- 4 polar covalent bonds
- 3 polar covalent bonds

71. 69. Which one of the following organic functional groups does not contain a carbon-oxygen double bond? 1 point

Mark only one oval.

- Nitrile
- Ester
- Carboxylic acid
- Aldehyde

72. 70. Which of the following is the alcohol functional group? 1 point

Mark only one oval.

- -OH
- -COOH
- -COH
- -OR

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