

Chemistry, 2010 EC, entrance exam

Grade 12 · Chemistry · 2010 E.C.

Time allowed: 120 minutes

Questions: 71

Total marks: 71

Name _____ Grade _____ ID No. _____ Date _____

1. Fats and oils are: (1)

A. Acids	B. Alcohols
C. Alkenes	D. Esters

2. The reaction between alcohols and acyl chlorides produces (1)

A. Ethers	B. Esters
C. Carboxylic acids	D. Aromatic salts

3. When a student draws a plausible Lewis structure for hydrazine molecule (N_2H_4), how many lone pair of electrons are available? (1)

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

4. Who used the cathode Ray tube to discover the electron and determine its charge to mass ratio? (1)

A. Robert A. Millikan	B. James Chadwick
C. J.J Thomson	D. Ernest Rutherford

5. Compounds that contain the carboxyl (carbonyl and hydroxyl) group are said to be: (1)

A. Organic acids	B. Ketones
C. Aldehydes	D. Esters

6. The main ore of lead is called: (1)

A. Zinc blend	B. Galena
C. Cinnabar	D. Chromite

7. During nitrification, bacterial convert into (1)

A. N_2 , N_2O in to nitrous oxide	B. NO_3^- , NH_4^+ or nitrates into ammonium
C. N_2 into nitrates	D. N_2 , nitrous oxide into nitrogen

8. Which one of the following metals exists in a free state? (1)

A. Na	B. Mg
C. Pt	D. Zn

9. A ___ ΔH corresponds to an ___ process. (1)

A. Negative, endothermic	B. Positive, exothermic
C. Zero, exothermic	D. Positive, endothermic

10. Which of the following is NOT both a Bronsted-Lowry acid and a Bronsted-Lowry base? (1)

A. HS^-	B. OH^-
C. HCO_3^-	D. HSO_4^-

11. Chlorine has an oxidation number of +5 in: (1)
- A. NaClO_3 B. NaClO_2
C. NaClO D. NaClO_4
-
12. What is a measure of the closeness of a measurement to its true value? (1)
- A. Accuracy B. Precision
C. Reproducibility D. Usefulness
-
13. The monomer of neoprene is: (1)
- A. Butadiene B. Isoprene
C. Chloroprene D. 2-methyl-1,3-butadiene
-
14. What is the sum of 3.72×10^8 and 4.62×10^7 to the correct significant figure? (1)
- A. 4.991×10^7 B. 4.17×10^8
C. 4.172×10^8 D. 4.99×10^7
-
15. Which of the following is a natural polymer? (1)
- A. PVC B. Rubber
C. Perspex D. Teflon
-
16. When a sodium chromate Na_2CrO_4 solution is acidified, it is converted to: (1)
- A. $\text{Cr}_2\text{O}_7^{2-}$ B. Cr_2O_3
C. CrO_3 D. Cr(s)
-
17. Nylons are:- (1)
- A. Amides B. Peptides
C. Polyesters D. Polyamides
-
18. Which quantum number is used to be determine sub shells? (1)
- A. Principal quantum number B. Magnetic quantum number
C. Spin quantum number D. Azimuthal quantum number
-
19. The maximum kinetic energy of a photoelectron emitted from a metal is $1.03 \times 10^{-19} \text{ J}$ when light that has a 656 nm wavelength shines on the surface. What is the threshold frequency for this metal? (1)
- A. $4.57 \times 10^{14} \text{ s}^{-1}$ B. $3.02 \times 10^{14} \text{ s}^{-1}$
C. $3.02 \times 10^{-14} \text{ s}^{-1}$ D. $4.57 \times 10^{-14} \text{ s}^{-1}$
-
20. What is the maximum number of electrons in an atom that can have the principal quantum number $n = 4$? (1)
- A. 34 B. 8
C. 32 D. 18
-
21. Which of the following questions expresses de Broglie's hypothesis? (1)
- A. $\lambda = h/(mv)$ B. $\Delta E = hc/\lambda$
C. $v = c/\lambda$ D. $\Delta E = c/\lambda$

22. What skill is a scientist using when he/she listens to the sounds that animals make? (1)

- A.** Drawing conclusions **B.** Making a hypothesis
C. Interpreting data **D.** Making observations

23. Which of the following is fundamentally different from the others? (1)

- A. Light waves
B. Radio waves
C. Sound waves
D. Microwaves

24. What is (are) the bond angle (s) in SF_6 ? (1)

- A. 109.5°
B. 90°
C. 90° and 109.5°
D. 180°

25. The number of resonance structures for CO_3^{2-} are: (1)

- A. 9
B. 2
C. 3
D. 6

26. In the following equation, what type of hybridization change, if any occurs at the Xe atom? $\text{XeF}_2(\text{s}) + \text{F}_2(\text{g}) \rightarrow \text{XeF}_4(\text{s})$ (1)

- A. sp^3d to sp^3d^2 B. dsp^2 to sp^3
C. sp^3 to sp^3d D. sp^3d to sp^3

27. Which of the following compounds does NOT contain an ionic bond? (1)

- A. NaOH
C. K₂S
- B. HCl
D. LiH

28. Which of the following statements about oxygen and fluorine is NOT correct? (1)

- A. O has a smaller atomic radius than F.
B. O has a smaller electron affinity than F.
C. O^{2-} has a larger ionic radius than F^{-} .
D. O and F have the same number of core electrons.

29. What will be the charges on the ions formed when silicon reacts with nitrogen? (1)

- A. $\text{Si}^{2+}, \text{N}^{2-}$
B. $\text{Si}^{3+}, \text{N}^{3-}$
C. $\text{Si}^{4+}, \text{N}^{2-}$
D. $\text{Si}^{4+}, \text{N}^{3-}$

30. The equilibrium constant for the ionization of HCN is 4.9×10^{-10} $\text{HCN} \rightleftharpoons \text{H}^+ + \text{CN}^-$ $K = 4.9 \times 10^{-10}$ (1)
Which of the following statements is true regarding this equilibrium? (I) The reaction is product favoured. (II) The reaction is reactant favoured. (III) Equilibrium lies far to the right. (IV) Equilibrium lies far to the left.

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

31. The rate equation for the decomposition of nitramide, $\text{H}_2\text{NNO}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$ is $\text{rate} = k[\text{H}_2\text{NNO}_2][\text{H}^+]^{-1}$ (1)
which of the following mechanisms is consistent with this rate equation?
- $\text{H}_2\text{NNO}_2 \rightleftharpoons \text{H}^+ + \text{HNNO}_2^-$ fast equilibrium; $\text{HNNO}_2^- \rightarrow \text{N}_2\text{O} + \text{OH}^-$ slow; $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ fast
 - $\text{H}_2\text{NNO}_2 + \text{H}^+ \rightleftharpoons \text{H}_3\text{NNO}_2^+$ fast; $\text{H}_3\text{NNO}_2^+ \rightarrow \text{N}_2\text{O} + \text{H}_3\text{O}^+$ slow; $\text{H}_3\text{O}^+ \rightleftharpoons \text{H}^+ + \text{H}_2\text{O}$ fast equilibrium
 - $\text{H}_3\text{NN}_2^+ \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$ slow
 - $\text{H}_2\text{NNO}_2 \rightarrow \text{OH}^- + \text{NH}_4^+$ slow; $\text{NH}_4^+ \rightleftharpoons \text{NH}_3 + \text{H}^+$ fast equilibrium; $\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$ fast equilibrium
-
32. Given the equilibrium constant values: $\text{N}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}(\text{g})$ $K_c = 3.4 \times 10^{-18}$ $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ $K_c = 4.6 \times 10^{-3}$ $1/2\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{NO}_2(\text{g})$ $K_c = 4.1 \times 10^{-9}$ What is the value of K_c for the following reaction? $2\text{NO}_2 + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{N}_2\text{O}_4(\text{g})$ (1)
- 1.2×10^{-6}
 - 2.4×10^{-6}
 - 1.2×10^6
 - 4.8×10^6
-
33. Which of the following factors does NOT affect the rate of a chemical reaction? (1)
- Concentration
 - Nature of reactants
 - Temperature
 - Humidity
-
34. Which of the following orbital diagrams is correct for the carbide ion (C_2^{2-})? (1)
- $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4$
 - $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4 \sigma_{2p}^2 \pi_{2p}^{*2}$
 - $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4 \sigma_{2p}^2$
 - $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4 \sigma_{2p}^2 \pi_{2p}^{*4}$
-
35. If a reaction is zero order in A, tripling the concentration of A will cause the reaction rate to: (1)
- Increase by a factor of 3
 - Remain constant
 - Increase by a factor of 27
 - Increase by a factor of 9
-
36. The phrase "like dissolves like" refers to the fact that: (1)
- Polar solvents dissolve non polar solutes and vice versa
 - Solvents can only dissolve solutes of similar molar mass
 - Polar solvents dissolve polar solutes and non-polar solvents dissolve non polar solutes
 - Gases can only dissolve other gases
-
37. 38 An ester has the structural formula shown below. On hydrolysis, the ester would produce: (1)
[Figure: A printed skeletal/condensed structural formula of an ester. On the left, written on one line, is the chain $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}$. From that terminal carbon two bonds branch to the right: an upward-sloping double bond (two parallel lines) to an O written above and to the right, and a downward-sloping single bond to OCH_2CH_3 written below and to the right. The overall structure is ethyl butanoate, $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OCH}_2\text{CH}_3$.]
- Propanoic acid and propan-1-ol
 - Butanoic acid and ethanol
 - Ethanoic acid and butan-1-ol
 - Propanoic acid and ethanol
-
38. You are given a bottle of solid x and three aqueous solutions of Y, the first saturated the second unsaturated and the third supersaturated. Which of the following is correct, if you add a small amount of the solid solute to each solution? (1)
- The solution in which the added solid solute dissolves is the saturated solution.
 - The solution in which the added solid solute remains undissolved is the unsaturated solution.
 - In all the three solution, saturated. Unsaturated and supersaturated the added solid solute will dissolve.
 - The supersaturated solution is unstable and addition of additional solute causes the excess solute to crystallize.

39. Consider the following equilibrium: $2\text{CO(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{CO}_2\text{(g)}$ $K_{\text{eq}} = 4.0 \times 10^{-10}$ What is the value of K_{eq} for $2\text{CO}_2\text{(g)} \rightleftharpoons 2\text{CO(g)} + \text{O}_2\text{(g)}$? (1)
- A. 2.5×10^9 B. 2.0×10^{-5}
C. 5.0×10^4 D. 4.0×10^{-10}
-
40. For a certain gas phase reaction $2\text{A(g)} \rightleftharpoons \text{B(g)} + \text{C(g)}$ $\Delta H = +45\text{KJ/mol}$ $K = 4.5 \times 10^{-2}$ Which of the following would be true if the temperature was increased from 25°C to 200°C ? I. The value of k would be smaller. II. The concentration of A(g) would be increased III. The concentration of B(g) would increase (1)
- A. I B. II
C. I and II D. III
-
41. Which of the following compounds would be the most soluble in H_2O ? (1)
- A. Ethane B. Pentane
C. Ethanoic acid D. Octanoic acid
-
42. A 0.2M solution of a weak acid HA is 1% ionized at 25°C K_a for the acid is equal to: (1)
- A. $\frac{0.01 \times 0.01}{0.19}$ B. $\frac{0.02 \times 0.02}{0.18}$
C. $\frac{0.002 \times 0.002}{0.198}$ D. $\frac{0.18}{0.01 \times 0.01}$
-
43. What species of ions are present in a 0.1M solution of HCl and what will be their equilibrium concentrations? (1)
- A. $[\text{H}_3\text{O}^+] = 0.1\text{M}$; $[\text{OH}^-] = 10^{-13}\text{M}$, $[\text{Cl}^-] = 0.1\text{M}$ B. $[\text{H}_3\text{O}^+] = 0.1\text{M}$; $[\text{OH}^-] = 0.1\text{M}$, $[\text{Cl}^-] = 0.1\text{M}$
C. $[\text{H}_3\text{O}^+] = 0.1\text{M}$; $[\text{OH}^-] = 0.01\text{M}$, $[\text{Cl}^-] = 0.1\text{M}$ D. $[\text{H}_3\text{O}^+] = 10^{-13}$; $[\text{OH}^-] = 0.1\text{M}$, $[\text{Cl}^-] = 0.1\text{M}$
-
44. Commercial concentrated sulphuric acid (density = 1.831gcm^{-3}) is 94.0% H_2SO_4 by mass. What is the normality of H_2SO_4 ? (1)
- A. 16.8M B. 35.0N
C. 28.2 D. 40.4M
-
45. 2.3g of ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) is added to 500g of water. What is the molality of the resulting solution? (1)
- A. 0.1m B. 0.01m
C. 1.0m D. 10.0m
-
46. A 0.5L and 0.1M HNO_3 solution is to be prepared by dilution process from a 13M nitric acid. How many ml conc. HNO_3 and how many ml of water are required to prepare the dilute solution? (1)
- A. 2ml HNO_3 and 498 ml water B. 10ml HNO_3 and 490ml water
C. 20ml HNO_3 and 490ml water D. 3.85ml HNO_3 and 496.15ml water
-
47. During the electrolysis of a concentrated aqueous solution of NaCl, what substance is formed at the cathode? (1)
- A. Chlorine B. Hydrogen
C. Oxygen D. Sodium
-
48. In a voltaic cell, electrons flow from the _____ to the _____ (1)
- A. Anode, cathode B. Salt bridge, anode
C. Anode, salt bridge D. Salt bridge, cathode

49. What is the PH of a mixture of 15.0ml of 0.126M NaOH and 21.0M H_2SO_4 ? (1)
- A. 1.7
B. 11.81
C. 2.15
D. 13.6
50. Which of the following correctly lists electromagnetic waves in order from shortest to longest wavelength? (1)
- A. Microwaves, ultraviolet, visible light, gamma rays
B. Gamma rays, ultraviolet, infrared, microwaves
C. Radio waves, infrared, gamma rays, ultraviolet
D. Gamma rays, infrared, ultraviolet, microwaves
51. The relationship between Pico meter (pm) and nanometre (nm) is: (1)
- A. $1\text{nm} = 1000\text{pm}$
B. $1\text{nm} = 10\text{pm}$
C. $1\text{pm} = 100\text{nm}$
D. $1\text{pm} = 10\text{nm}$
52. What would be the wavelength of a radio wave having a frequency of 3 MHz? (1)
- A. 100nm
B. 300m
C. 100m
D. 300nm
53. The process of vulcanization of rubber makes it (1)
- A. More soluble in solvents
B. Soft
C. Less elastic
D. Hard
54. Which of the following is NOT the decomposition product of HNO_3 ? (1)
- A. NO_2
B. O_2
C. N_2O_4
D. H_2O
55. The determine the volume of an irregularly shaped glass vessel, the vessel is weighed empty (121.3g) and when (1)
filled with CCl_4 (283.2g). What is the volume capacity of the vessel, given that the density of CCl_4 is $1.59\text{g}/\text{cm}^3$?
- A. 76.29cm^3
B. 178.11cm^3
C. 101.82cm^3
D. 257.42cm^3
56. For the reaction $\text{C}_6\text{H}_{14}(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{g}) + 4\text{H}_2(\text{g})$, $\Delta p(\text{H}_2)/\Delta t$ was found to be $2.5 \times 10^{-2} \text{ atm/s}$, where (1)
 $\Delta p(\text{H}_2)$ is change in the pressure of hydrogen. Determine $\Delta p(\text{H}_6\text{H}_{14})/\Delta t$ in units of atm/s for this reaction at the same time.
- A. 6.2×10^{-2}
B. 1.6×10^{-3}
C. -6.2×10^{-3}
D. 2.5×10^{-2}
57. The decomposition of a compound at 400°C is first order with a half - life of 1570 seconds what fraction of an (1)
initial amount of the compound remains after 4710 seconds?
- A. 1/8
B. 1/12
C. 1/6
D. 1/3
58. Given the following AF_n species, BF_3 , BeF_2 , CF_4 , NF_3 , OF_2 . What is the correct order of F - A - F bond (1)
angles?
- A. $\text{OF}_2 < \text{BeF}_2 < \text{NF}_3 < \text{BF}_3 < \text{CF}_4$
B. $\text{BeF}_2 < \text{OF}_2 < \text{NF}_3 < \text{BF}_3 < \text{CF}_4$
C. $\text{CF}_4 < \text{NF}_3 < \text{BeF}_2 < \text{OF}_2$
D. $\text{OF}_2 < \text{NF}_3 < \text{CF}_4 < \text{BF}_3 < \text{BeF}_2$

59. How many electrons are present in the σ_{2p} molecular orbital of N_2^+ ? (1)
- A. 2
B. 1
C. 3
D. 4
60. A solution of NH_4Cl made by dissolving 3.16g NH_4Cl in 30.14g H_2O has a density of $1.0272g\ cm^{-3}$. What is the mole fraction of NH_4Cl ? (1)
- A. 0.9659
B. 0.21
C. 0.65
D. 0.0341
61. Which of the following is true regarding the solution formation process? (1)
- A. New coulombic attraction between the solute and solvent form in which the enthalpy change is exothermic ($\Delta H < 0$)
B. Intermolecular forces between the solvent molecules must weaken in which the enthalpy change is exothermic ($\Delta H < 0$)
C. Intermolecular forces between the solute particles must weaken in which the enthalpy change is exothermic ($\Delta H < 0$)
D. Covalent bonds within the solute and solvent molecules must be broken
62. What volume of 1.40M H_2SO_4 solution is needed to react exactly with 10.0g of aluminium according of the following reaction? $2Al(s) + 2H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$ (1)
- A. 2.643ml
B. 264.3ml
C. 26.43ml
D. 2643ml
63. Which of the following statements is NOT true in relation to the triple point on a single component phase diagram? (1)
- A. The point at which the solid, liquid and gaseous phases for a substance co-exist.
B. The triple point exists at a single temperature and is independent of pressure.
C. The system must be enclosed so that no Vapour can escape
D. The triple point exists for a substance occurs at a specific temperature and pressure.
64. Consider the following equilibrium: $Cl_2(g) + 2NO(g) \rightleftharpoons 2NOCl(g)$ $K_{eq} = 5.0$ At equilibrium, $[Cl_2] = 1.0M$ and $[NO] = 2.0M$. What is the $[NOCl]$ at equilibrium? (1)
- A. 0.80M
B. 0.89
C. 10M
D. 4.5M
65. Which acid is produced when toluene is subjected to $KMnO_4$ oxidation? (1)
- A. Phenyl acetic acid
B. Toluic acid
C. Benzoic acid
D. Phthalic acid
66. Calculate ΔH for the following reaction using the bond energies given below $H - H(g) + I - I(g) \rightarrow 2H - I(g)$ bond energies: $H - H = 436KJ/mol$, $I - I = 151KJ/mol$, $H - I = 297KJ/mol$ (1)
- A. -7KJ
B. -290KJ
C. +7KJ
D. +290KJ
67. How long has a current of 3 ampere to be applied through a solution of silver nitrate to coat a metal surface of $80cm^2$ with 0.005cm thick layer? Density of silver = $10.5gcm^{-3}$ (1)
- A. 476s
B. 1252s
C. 683s
D. 1028s

68. Which of the following is an organic acid?

(1)

- A. $\text{CH}_3\text{CH}_2\text{OH}$
C. $\text{CH}_2 = \text{CH}_2$
- B. CH_3CH_3
D. $\text{CH}_3\text{CO}_2\text{H}$

69. During a titration what volume of 0.500M KOH is necessary to completely neutralize 10.0ml of 2.00M CH_3COOH ?

(1)

- A. 10.0ml
B. 40.0ml
C. 25.0ml
D. 20.0ml

70. What is the standard cell potential of the oxidation of ammonia, given below? $4\text{NH}_3 + 3\text{O}_2 \rightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$ $\Delta G^0 = -1356\text{KJ}$

(1)

- A. 7.02V
B. 3.51V
C. 1.17V
D. 14.04V

71. Two electrolytic cells were placed in series, one of AgNO_3 and the other of CuSO_4 . If 1.273g Ag is deposited, how much Cu was deposited, how much Cu was deposited at the same time?

(1)

- A. 0.374
B. 0.0118
C. 0.748
D. 0.954

— END OF EXAMINATION —