NATIONAL EDUCATIONAL ASSESMENT AND EXAMINATIONS AGENCY (NEAEA)
ETHIOPIAN UNIVERSITY ENTRANCE EXAMINATION (EUEE)
CHEMISTRY EXAMINTION 2010

BOOKLET CODE: 00
NUMBER OF ITEMS:

SUBJECT CODE: 00
TIME ALLOWED: 00

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Choose the best answer. You may refer to the information given below when you work on some of the questions.

PHYSICAL CONSTANTS:

a. Gas constant, R = 8.314J mol^{-1} K^{-1} = 0.0821L - atm $mol^{-1}K^{-1}$

b. Avogadro's number = 6.023 x $10^{23}mol^{-1}$

c. Plank's constant, h = 6.626 x $10^{-34}Js^{-1}$

d. Energy, 1eV = 1.602 x $10^{8}J$

e. Speed of light, c= 2.9979 x $10^{-18}ms^{-1}$

f. Faraday's constant(F) = 96500$cmol^{-1}e$

g. Charge of 1 mole of electrons = 69500C

R_H = 2.18 x $10^{-18}J$

SI Units and Conversation Factors

a. 1ton = 907.185 kg

b. 1metic ton = 1000kg

c. 1A = $10^{-18}m$

d. 1L-atm = 101.3J

e. Coulombs = amperes x seconds

ATOMIC NUMBER (Z) AND ATOMIC WEIGHTS (A)

Element	H	He	Li	B	C	N	O	F	Ne	Na	P	S	Cl	Ca	Cr
Z	1	2	3	5	6	7	8	9	10	11	15	16	17	20	24
A	1.0	4.0	6.9	10.8	12.0	14.0	16.0	19.0	20.2	22.98	30.97	32.1	35.5	40.1	52.0

Element	Fe	Mn	Co	Ni	Cu	Zn	Ag	Cd	Au	Hg
Z	26	25	27	28	29	30	47	48	79	80
A	55.9	54.9	58.7	58.7	63.5	65.4	017.9	112.4	197.0	200.6

1. Fats and oils are:

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

2. The reaction between alcohols and acyl chlorides produces

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

3. Which one of the following aqueous solutions will have the LOWEST freezing point?

- A. Aq. 0.50m KF

- B. Aq. 0.60m glucose
- C. Aq. 0.24m FeI_3
- D. Pure H_2O

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

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

5. Who used the cathode Ray tube to discover the electron and determine its charge to mass ratio?

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

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

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

7. The main ore of lead is called:

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

8. During nitrification, bacterial convert into

- 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

9. Which one of the following metals exists in a free state?

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

10. A ___ ΔH corresponds to an ___ process.

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

11. Which of the following is NOT both a Bronsted-Lowry acid and a Bronsted-Lowry base?

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

12. Chlorine has an oxidation number of +5 in:

- A. $NaClO_3$
- B. $NaClO_2$
- C. NaClO
- D. $NaClO_4$

13. What is a measure of the closeness of a measurement to its true value?

- A. Accuracy
- B. Precision
- C. Reproducibility
- D. Usefulness

14. The monomer of neoprene is:

- A. Butadiene
- B. Isoprene
- C. Chloroprene
- D. 2-methyl-1,3-butadiene

15. What is the sum of 3.72×10^8 and 4.62×10^7 to the correct significant figure?

- A. 4.991×10^7
- B. 4.17×10^8
- C. 4.172×10^8
- D. 4.99×10^7

16. Which of the following is a natural polymer?

- A. PVC
- B. Rubber
- C. Perspex
- D. Teflon

17. When a sodium chromate Na_2CrO_4 solution is acidified, it is converted to:

- A. $Cr_2O_7^{-2}$
- B. Cr_2O_3
- C. CrO_3
- D. Cr(s)

18. Nylons are:-

- A. Amides
- B. Peptides
- C. Polyesters
- D. Polyamides

19. Which quantum number is used to be determine sub shells?

- A. Principal quantum number
- B. Magnetic quantum number
- C. Spin quantum number
- D. Azimuthal quantum number

20. The maximum kinetic energy of a photoelectron emitted from a metal is 1.03×10^{-19}J when light that has a 656 nm wavelength shines on the surface. What is the threshold frequency for this metal?

- A. $4.57 \times 10^{14} s^{-1}$

- B. $3.02 \times 10^{14} s^{-1}$
- C. $3.02 \times 10^{-14} s^{-1}$
- D. $4.57 \times 10^{-14} s^{-1}$

21. What is the maximum number of electrons in an atom that can have the principal quantum number n = 4?

- A. 34
- B. 8
- C. 32
- D. 18

22. Which of the following questions expresses de Broglie's hypothesis?

- A. $\lambda = h/(mv)$
- B. $\Delta E = hc/\lambda$
- C. $v=c/\lambda$
- D. $\Delta E = c/\lambda$

23. What skill is a scientist using when he/she listens to the sounds that animals make?

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

24. Which of the following is fundamentally different from the others?

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

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

- A. 109.5^0
- B. 90^0
- C. 90^0 and 109.5^0
- D. 180^0

26. The number of resonance structures for CO_3^{-2} are:

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

27. In the following equation, what type of hybridization change, if any occurs at the Xe atom? XeF2(s) + F2(g) → XeF4(s)

- 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

28. Which of the following compounds does NOT contain an ionic bond?

- A. NaOH
- B. HCl
- C. K_2S
- D. LiH

29. Which of the following statements about oxygen and fluorine is NOT correct?

- 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.

30. What will be the charges on the ions formed when silicon reacts with nitrogen?

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

31. The equilibrium constant for the ionization of HCN is 4.9×10^{-10}
$HCN \rightleftharpoons H^{+} + CN^{-} K = 4.9 \times 10^{-10}$
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

32. The rate equation for the decomposition of nitramide, $H_2NNO_2 \rightarrow N_2O + H_2O$ is rate = $k[H_2 NNO_2][H^{+}]^{-1}$ which of the following mechanisms is consistent with this rate equation?

- A. $H_2NNO_2 \rightleftharpoons H^{+} + HNNO_2$ fast equilibrium
  $HNNO^{-}_2 \rightarrow N_2O + OH^{-}$ slow
  $H^{+} + OH^{-} \rightarrow H_2O$ fast
- B. $H_2NNO_2+ \rightarrow H+ \rightleftharpoons H_3NNO^{+}_2$ fast
  $H_3 NNO^{+}_2 \rightarrow N_2O + H_3O^{+}$ slow
  $H_3O^{+} \rightleftharpoons H^{+} + H_2O$ fast equilibrium
- C. $H_3NN^{+}_2 \rightarrow N_2O + H_2O$ slow
- D. $H_2NNO_2 \rightarrow OH^{-} + NH^{+}_4$ slow
  $NH^{+}_4 \rightleftharpoons NH_3 + H^{+}$ fast equilibrium
  $H_2O \rightleftharpoons H^{+} + OH^{-}$ fast equilibrium

33. Given the equilibrium constant values:
$N_2(g) + 1/2\ O_2\ (g) \rightleftharpoons N_2O(g)\ K_c = 3.4 \times 10^{-18}$
$N_2O_4(g) \rightleftharpoons 2NO_2(g)\ K_c = 4.6 \times 10^{-3}$
$1/2N_2(g) + O_2(g) \rightleftharpoons NO_2(g)\ K_c = 4.1 \times 10^{-9}$
What is the value of K_c for the following reaction?
$2NO_2 + 3O_2(g) \rightleftharpoons 2N_2O_4(g)$

- A. 1.2 ?x 10^{-6}
- B. 2.4×10^{-6}
- C. 1.2×10^{6}
- D. 4.8×10^{6}

34. Which of the following factors does NOT affect the rate of a chemical reaction?

- A. Concentration
- B. Nature of reactants
- C. Temperature
- D. Humidity

35. Which of the following orbital diagrams is correct for the carbide ion(C^{2-}_2)?

- A. $\sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \pi_{2p}^4$
- B. $\sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \pi_{2p}^4\ \sigma_{2p}^2\ \pi_{2p}^{*2}$
- C. $\sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \pi_{2p}^4\ \sigma_{2p}^2$
- D. $\sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \pi_{2p}^4\ \sigma_{2p}^2\ \pi_{2p}^{*4}$

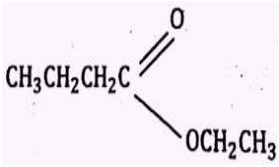
36. If a reaction is zero order in A, tripling the concentration of A will cause the reaction rate to:

- A. Increase by a factor of 3
- B. Remain constant
- C. Increase by a factor of 27
- D. Increase by a factor of 9

37. The phrase "like dissolves like" refers to the fact that:

- A. Polar solvents dissolve non polar solutes and vice versa
- B. Solvents can only dissolve solutes of similar molar mass
- C. Polar solvents dissolve polar solutes and non-polar solvents dissolve non polar solutes
- D. Gases can only dissolve other gases

38 An ester has the structural formula shown below. On hydrolysis, the ester would produce:



- A. Propanoic acid and propan -1 ol
- B. Bunanoic acid and ethanol
- C. Ethanoic acid and butan -1 -ol
- D. Propanoic acid and ethanol

39. 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?

- A. The solution n which the added solid solute dissolves is the saturated solution.
- B. The solution is which the added solid solute remains undissolved is the unsaturated solution.
- C. In all the three solution, saturated. Unsaturated and supersaturated the added solid solute will dissolve.
- D. The supersaturated solution is unstable and addition of additional solute causes the excess solute to crystallize.

40. Consider the following equilibrium:
$2CO(g) + O_2(g) \rightleftarrows 2CO_2(g)$ $K_{eq} = 4.0 \times 10^{-10}$
What is the value of K_{eq} for $2CO_2(g) \rightleftarrows 2CO(g) + O_2(g)$?

- A. 2.5×10^{9}
- B. 2.0×10^{-5}
- C. 5.0×10^{4}
- D. 4.0×10^{-10}

41. For a certain gas phase reaction
$2A(g) \rightleftarrows B(g) + C(g)$ $\Delta H = +45KJ/mol$ $K = 4.5 \times 10^{-2}$
Which of the following would be true if the temperature was increased from 25^0C to 200^0C?
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

- A. I

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

42. Which of the following compounds would be the most soluble in H_2O?

- A. Ethane
- B. Pentane
- C. Ethanoic acid
- D. Octanoic acid

43. A 0.2M solution of a weak acid HA is 1% ionized at 25^0C K_a for the acid is equal to:

- A. $\frac{0.01\ x\ 0.01}{0.19}$
- B. $\frac{0.02\ x\ 0.02}{0.18}$
- C. $\frac{0.002\ x\ 0.002}{0.198}$
- D. $\frac{0.19}{0.01\ x\ 0.01}$

44. What species of ions are present in a 0.1M solution of HCl and what will be their equilibrium concentrations?

- A. $[H_3O]^+ = 0.1M$; $[OH]^- = 10^{-13}M$, $[Cl]^- = 0.1M$
- B. $[H_3O]^+ = 0.1M$; $[OH]^- = 0.1M$, $[Cl]^- = 0.1M$
- C. $[H_3O]^+ = 0.1M$; $[OH]^- = 0.01M$, $[Cl]^- = 0.1M$
- D. $[H_3O]^+ = 10^{-13}$; $[OH]^- = 0.1M$, $[Cl]^- = 0.1M$

45. A solution in which prop ionic acid is 0.94% ionized has a PH of 2.85. What is the value of the acid ionization constant (Ka) for prop ionic acid?

- A. 4.2×10^{-4}
- B. 1.3×10^{-5}
- C. 8.7×10^{-5}
- D. 6.8×10^{-4}

46. Commercial concentrated sulphuric acid (density = $1.831gcm^{-3}$) is 94.0% H_2SO_4 by mass. What is the normality of H_2)

- A. 16.8M
- B. 35.0N
- C. 28.2
- D. 40.4M

47. 2.3g of ethanol (CH_3CH_2OH) is added to 500g of water. What is the molality of the resulting solution?

- A. 0.1m
- B. 0.01m
- C. 1.0m
- D. 10.0m

48. A 0.5L and 0.1 MHNO_3 solution is to be prepared by dilution process form a 13M nitric acid. How many ml conc. HNO_3 and how many ml of water are required to prepare the dilute solution?

- 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

49. During the electrolysis of $CuSO_4$(aq) using carbon electrodes, which of the following is the correct half reaction for the anode electrode?

- A. $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
- B. $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$
- C. $SO_4^{2-}(g) + O_2(g) + 4H^+(aq) \rightarrow So_4^{2-}(aq) + 2H_2O(l)$
- D. $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

50. During the electrolysis of a concentrated aqueous solution of NaCl, what substance is formed at the cathode?

- A. Chlorine
- B. Hydrogen
- C. Oxygen
- D. Sodium

51. In a voltaic cell, electrons flow from the_____ to the _____

- A. Anode, cathode
- B. Salt bridge, anode
- C. Anode, salt bridge
- D. Salt bridge, cathode

52. What is the PH of a mixture of 15.0ml of 0.126M NaOH and 21.0M H_2SO_4?

- A. 1.7
- B. 11.81
- C. 2.15
- D. 13.6

53. Which of the following statement is true?

- A. Addition of $NaNO_2$ to a solution of HNO_2 will decrease the PH.
- B. Addition of HCl to a solution of $NaC_2H_3O_2$ will increase the PH.
- C. Addition of KBr to a solution of HBr will increase the PH.
- D. Addition of CH_3NH_3Cl to a solution of CH_3NH_2 will decrease the PH.

54. What is final temperature when 150.0ml of water at 90.0^0C is added to 100.0ml of water at 30.0^0C?

- A. 66.0^0C
- B. 45.0^0C
- C. 60.0^0C
- D. 33.0^0C

55. Which of the following correctly lists electromagnetic waves in order from shortest to longest wavelength?

- 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

56. The relationship between Pico meter (pm) and nanometre (nm) is:

- A. 1nm = 1000pm
- B. 1nm = 10pm
- C. 1pm = 100nm
- D. 1pm = 10nm

57. What would be the wavelength of a radio wave having a frequency of 3 MHz?

- A. 100nm
- B. 300m
- C. 100m

○ D. 300nm

58. The process of vulcanization of rubber makes it

○ A. More soluble in solvents
○ B. Soft
○ C. Less elastic
○ D. Hard

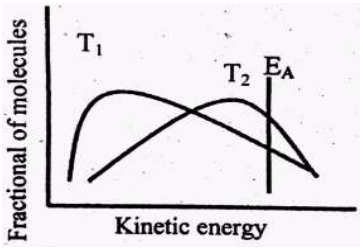
59. Which of the following is NOT the decomposition product of HNO_3?

○ A. NO_2
○ B. O_2
○ C. N_2O_4
○ D. H_2O

60. The determine the volume of an irregularly shaped glass vessel, the vessel is weighed empty (121.3g) and when filled with CCl_4 (283.2g). What is the volume capacity of the vessel, given that the density of CCl_4 is 1.59g/cm^3?

○ A. 76.29cm^3
○ B. 178.11cm^3
○ C. 101.82cm^3
○ D. 257.42cm^3

61. The diagram below shows the range of energies of collision of a collection of reactants at two temperatures, T_1 and T_2. Which of the following is true regarding T_1 and T_2?



○ A. $T_1 = T_2$, fraction of molecules at both temperatures are equal.
○ B. $T_2 < T_1$, fraction of molecules at T_2 is smaller.
○ C. $T_1 < T_2$, fraction of molecules at T_1 is larger.
○ D. $T_1 < T_2$, fraction of molecules at T_1 is smaller.

62. For the reaction $C_6H_{14}(g) \rightarrow C_6H_6(g) + 4H_2(g)$, $\Delta p(H_2)/\Delta t$ was found to be 2.5 x 10^{-2} atm/s, where $\Delta p(H_2)$ is change in the pressure of hydrogen. Determine $\Delta p(H_6H_{14})/\Delta t$ in units of atm/s for this reaction at the same time.

○ A. 6.2 x 10^{-2}
○ B. 1.6 x 10^{-3}
○ C. -6.2 x 10^{-3}
○ D. 2.5 x 10^{-2}

63. The decomposition of a compound at 400^{0}C is first order with a half - life of 1570 seconds what fraction of an initial amount of the compound remains after 4710 seconds?

○ A. 1/8
○ B. 1/12
○ C. 1/6
○ D. 1/3

64. 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 angles?

○ A. $OF_2 < BeF_2 < NF_3 < BF_3 < CF_4$
○ B. $BeF_2 < OF_2 < NF_3 < BF_3 < CF_4$
○ C. CF_4 4 < $NF_3 < BeF_2 < OF_2$

- D. $OF_2 < NF_3 < CF_4 < BF_3 < BeF_2$

65. From CO_2, H_2O, $BeCl_2$ and N_2O which have the same molecular geometry?

- A. CO_2, H_2O and N_2O
- B. CO_2, $BeCl_2$ and N_2O
- C. CO_2 and $BeCl_2$ only
- D. H_2O and N_2O only

66. How many electrons are present in the σ_{2p} molecular orbital of N_2^+?

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

67. 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?

- A. 0.9659
- B. 0.21
- C. 0.65
- D. 0.0341

68. Which of the following is true regarding the solution formation process?

- 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

69. What volume of 1.40M H_2SO_4 solution is needed to react exactly with 10.0g of aluminium according of the following reaction?
$2Al(s) + 2H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

- A. 2.643ml
- B. 264.3ml
- C. 26.43ml
- D. 2643ml

70. Which of the following statements is NOT true in relation to the triple point on a single component phase diagram?

- 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.

71. Consider the following equilibrium:
$Cl_2(g) + 2NO(g) \rightleftarrows 2NOCl(g)$ Keq = 5.0
At equilibrium, [Cl_2] = 1.0M and [NO]= 2.0M. What is the [NOCl] at equilibrium?

- A. 0.80M
- B. 0.89
- C. 10M
- D. 4.5M

72. Which acid is produced when toluene is subjected to KM_nO_4 oxidation?

- A. Phenyl acetic acid
- B. Toluic acid
- C. Benzoic acid
- D. Phthalic acid

73. Which of the following statement is true?

- A. If the entropy of the system increases during a reversible process, the entropy change will also increase by the same amount.
- B. If the entropy of the system increases during a reversible process, the entropy change of the surroundings will remain the same
- C. If the entropy of the system increases during a reversible process, the entropy change of the surroundings will decrease by the same amount
- D. If the entropy of the system decreases during a reversible process, the entropy change of the surroundings will also decreases by the same amount

74. Calculate ΔH for the following reaction using the bond energies given below H - H(g) + I - I(g) → 2H - I (g) bond energies: H - H = 436KJ/mol, I - I = 151KJ/mol, H - I = 297KJ/mol

- A. -7KJ
- B. -290KJ
- C. +7KJ
- D. +290KJ

75. 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 = $10.5gcm^{-3}$

- A. 476s
- B. 1252s
- C. 683s
- D. 1028s

76. Which of the following is an organic acid?

- A. CH_3CH_2OH
- B. CH_3CH_3
- C. $CH_2 = CH_2$
- D. CH_3CO_2H

77. What is the freezing point of a 0.1m solution of NaCl (in ^0C)? KT = 1.860C/m and the freezing point of pure water is (^0C)

- A. -0.186
- B. -0.372
- C. -1.86
- D. -0.093

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

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

79. What is the standard cell potential of the oxidation of ammonia, given below?
$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$ $\Delta G^0 = -1356KJ$

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

80. 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?

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

Submit