CHEMISTRY 200
Final

Spring 97/98
2 Hours

Family Name _____
First Name _____
ID No _____

Instructions

Answer all questions
All answers must be clearly indicated by a vertical line in the box of your choice on the answer sheet as indicated below:

If you make a mistake cross it out, as indicated below:

There is only one correct answer per question
There is no penalty for a wrong answer
If more than one box is filled per question (except to cross out mistakes), then that question will not be graded

Constants and data

R = 0.082 L.atm/K.mol
Avogadro's number 6.023×10^{23} amu/g
Molar volume of ideal gas at STP =22.4 L

1. Cyanogen, is a highly poisonous gas gave on analysis 46.2% Cand 53.8% N. What is the molecular formula of cyanogen? its density at STP=2.32g/L

a CN
b C_2N
c C_4N_4
d C_2N_2

2. The correct structure of perchloric acid is

a $HClO_3$
b HCl
c $HClO_4$
d $HClO$

3. Calculate the answer to the proper number of significant figures of $(3.12\times10^{5})(8.123\times10^{-4})/3.1$

a 818
b 8.18
c 8.2×10^{2}
d 0.818

4. Find the number of moles of atoms in 0.14g of nitrogen

a 0.10
b 0.05
c 0.02
d 0.01

5. The concentration of OH^- ions in a solution which has a pH=5 is

a 2×10^{-5}
b 9×10^{-3}
c 2×10^{-9}
d non of the above

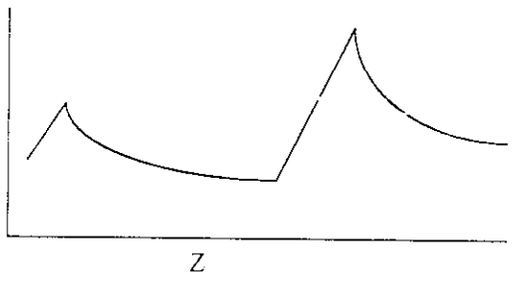
6. What mass of zinc will react completely with 50 ml of 0.10 M sulphuric acid.
a 350g
b 32.5g
c 3.25g
d 0.325g

7. For a solution that contains equimolar amounts of acetic acid and sodium acetate
a its pH increases drastically by slight addition of NaOH
b its pH decreases drastically by slight addition of NaOH
c no change is observed
d its pH changes slightly by addition of small amount of HCl

8. Calculate the solubility of the salt $BaSO_4$ in g/L , given that $K_{sp}=1.5\times10^{-9}$

a 3.9×10^{-5}
b 6.18×10^{-13}
c 9.2×10^{-3}
d 2.35×10^{5}

9. The graph below represents_____ Vs atomic number



a atomic radius
b ionization
c electron affinity
d electrostatic force

10. Chlorine exists in two isotopic forms, ^{35}Cl (34.9689 amu) and ^{37}Cl (36.9659 amu). The atomic mass of chlorine is 35.453 amu. What is the percentage abundance of each isotope?

a ^{37}Cl (24%) and ^{35}Cl (76%)
b ^{37}Cl (50%) and ^{35}Cl (50%)
c ^{37}Cl (80%) and ^{35}Cl (20%)
d ^{37}Cl (10%) and ^{35}Cl (90%)

11. Calculate $\Delta H°$ for the combustion of 1 mole of methane given the following information

	$\Delta Hf°$(Kcal/mol)
$CH_{4(g)}$	-17.9
$CO_{2(g)}$	-94.1
$H_2O_{(l)}$	-68.3

a -212.8
b -144.5
c -248.6
d 248.6

12. If 35.4g of $CHCl_3$ reacts with 6.40g of O_2 in the reaction below, what is the limiting reagent.

$2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

a $COCl_2$
b O_2
c HCl
d $CHCl_3$

13. For the redox reaction
$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$
which substance is oxidized

a Cr^{3+}
b H^+
c Cr^{6+}
d Fe^{2+}

14. Which of the following is not a chemical change

a candle burning
b tooth decaying
c bread becomes moldy
d snow melting

15. Which of the following is a Bronsted-Lowry acid

a HSO_4^-
b NaH
c SO_4^{2-}
d none of the above

16. The formal charges on the Carbon and Oxygen atom in carbon monoxide are

	C	O
a	0	0
b	−1	-1
c	-1	+1
d	0	+1

For question 17 and 18 the following information for benzene is given:

bp 80.10 °C
fp 5.5 °C
Kb 2.53 °C/m
Kf 5.12 °C/m

17. Calculate the bp of a solution of 9.75g of nitrobenzene ($C_6H_5NO_2$) in 175g of benzene

a 1.15
b 81.25
c 82.4
d 77.57

18. Calculate the fp of a solution of 9.75g of nitrobenzene ($C_6H_5NO_2$) in 175g of benzene

a 7.8
b 4.36
c 5.5
d 3.18

19. Calculate the percent by mass of a 6.0 M aqueous sulphuric acid solution (density 1.34 g/ml)

a 13
b 56
c 44
d 6

20. Which of the following statement is correct about the kinetic theory of gases

a The forces of attraction between gas molecules decrease as the molecules move closer together
b All gases are composed of molecules
c Gas molecules move faster when the temperature rises and slower when the temperature drops
d none of the above

21. 4 g of a mixture of $CaCO_3$ and sand is treated eith an excess of HCl , and 0.88g of CO_2 is produced. What % of $CaCO_3$ was in the original mixture

a 50%
b 25%
c 22%
d 75%

22. Predict which of the following reactions can occur

a $Cu + 2HCl \rightarrow CuCl_2 + H_2$
b $2Al + 3Zn(NO_3)_3 \rightarrow 2Al(NO_3)_3 + 3Zn$
c $Ni + AlCl_3 \rightarrow NiCl_3 + Al$
d none of the above

23. The following materials can be classified into one of the four types of crystalline solids. Which is the correct order

	Ionic	Molecular	Atomic-Metallic	AtomicNonmetallic
a	calicum	diamond	CsF	sucrose
b	sucrose	calicum	diamond	CsF
c	CsF	sucrose	calcium	diamond
d	diamond	CsF	sucrose	calicum

24. If the Ksp of CaF_2 is 1.7×10^{-10} at 25°C then the concentration of the fluoride ion in a saturated aqueous solution of CsF_2 at 25°C is given by

a $Ksp=x^3$
b $Ksp=2x^2$
c $Ksp=4x^2$
d $Ksp=4x^3$

25. The hydrofluoride acid in a 0.040 M solution is 13.4 % ionized. Calculate Ka for HF

a 1.2×10^{3}
b 1.5×10^{-1}
c 7.2×10^{-4}
d 8.3×10^{-4}

26. How many carbon atoms are there in 0.44g of carbon dioxide

a 1.2×10^{22}
b 6.023×10^{25}
c 6.023×10^{21}
d 8.21×10^{18}

27. The specific heat of aluminium is 0.214 cal/g.deg . Calculate the heat necessary to raise the temperature of 40.0g of aluminium from 20°C to 32.3°C

a 105 cal
b 171 cal
c 276 cal
d 95 cal

28. Dalton's law states that

a at constant temperature a fixed mas of gas occupies a volume inversely proportional to the pressure exerted on it
b at constant pressure the volume occupied by a fixed mass of gas is directly proportional to the absolute temperature
c the total pressure exerted by a mixture of gases is equal to the sum of the partial pressures of the various gases
d none of the above

29. How many ^{17}O atoms are there in a sample containing 1×10^{9} oxygen atoms if the natural abundance of ^{17}O is 0.037%.

a 37
b 370
c 3700
d 37000

30. Bundles of energy absorbed or emitted by electrons are called

a candela
b line spectra
c quanta
d newtons

31. Which is the correct answer showing the maximum number of electrons in a sublevel

	d	p	s	g	f
a	2	6	10	18	14
b	18	10	14	6	2
c	10	6	2	18	14
d	10	6	2	14	18

32. The undiscovered element (116 amu) would have the most common oxidation number

a -2
b +2
c -3
d +3

33. Determine the number of grams of H_2 gas present in a 2.0 litre container at a temperature of 127°C and a pressure of 2280 torr

a 0.36g
b 0.12g
c 28.4g
d 0.018g

34. For the Deacon process used in the preparation of chlorine gas, using Le Chatelier's principle which of the following is the correct statement

$$4HCl_{(g)} + O_{2(g)} \rightleftharpoons 2Cl_{2(g)} + 2H_2O_{(g)}$$

a concentration of O_2 increased: equilibrium shifts to the left
b concentration of H_2O decreased: equilibrium shifts to the left
c volume increased: equilibrium shifts to the right
d pressure increased: equilibrium shifts to the right

35. Suppose we collect a sample of oxygen gas over water at 27°C and at a pressure of 750 torr. The gas fills a 500 mL container but has water vapour mixed in with it. What would be the volume of the dry gas at STP if the vapour pressure of water at 27°C is 26.74 torr.

a 18 mL
b 450 mL
c 433 mL
d 460 mL

Answer Q36 and Q37 using the following equation:

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$$

36. How many grams of CO_2 is produced per gram of sucrose

a 3.08g
b 12.08g
c 14.32g
d 1.54g

37. How many moles of O_2 gas is needed to react with a gram of sucrose

a 0.035 mole
b 0.0029 mole
c 0.00025 mole
d 1.00 mole

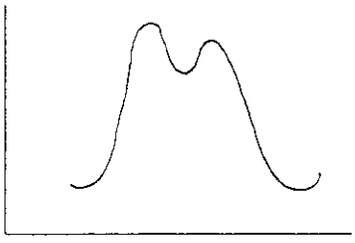
38. The density of a certain gas is 1.3 g/L at STP. Calculate the g/molecular mass of the gas

a 58.2
b 0.058
c 17.2
d 29.1

39. The reaction of a metal oxide + nonmetal oxide is an example of

a combination
b single displacement
c double displacement
d decomposition

40. The energy diagram below represents a



a exothermic reaction
b two-step reaction
c endothermic reaction
d none of the above

41. Which of the following is a polar molecule

a BF_2
b NH_3
c BF_3
d CCl_4

42. The density of hydrogen gas at STP in g/litre is

a 2.0
b 0.32
c 0.089
d 22.4

43. A sample of gas at 0°C and 1.0 atm occupies 2.5 litres. What change in temperature is necessary to adjust the pressure of that gas to 1.5 atm after it has been transferred to a 2.0 litre container

a increase of 55K
b decrease of 55K
c increase of 55°C
d none of the above

44. The acidic substance in vinegar is acetic acid. When 6.0g of vinegar was titrated with 0.10 M NaOH, 40.0 ml of base had to be added to reach the equivalence point. What percent by weight of this sample of vinegar is acetic acid

a 2%
b 4%
c 6%
d 8%

45. Calculate the pH of a buffer solution made by adding 0.001 mole sodium hydroxide to 200 ml of 0.50M acetic acid and 0.50M sodium acetate (Ka for acetic acid = $1.8x10^{-5}$)

a 4.75
b 4.76
c 4.74
d 4.77

46. Calculate the equilibrium concentration of acetic acid in a 0.50M acetic acid solution at 25°C. Ka=$1.8x10^{-5}$

a $3x10^{-3}$ mole/litre
b $6x10^{-3}$ mole/litre
c 0.497 mole/litre
d 0.994 mole/litre

47. You add 5.85g 0f sodium chloride to 1000g of water. What is the boiling point of the solution if K_b for water is 0.52 °C/m

a 99.948
b 100.052
c 99.896
d 100.104

48. If 12g nitrogen gas, 0.4g hydrogen gas and 9.0g oxygen are put into a 1.0 litre container at 27°C, what is the total pressure in the container?

a 10.6 atm
b 4.9 atm
c 6.9 atm
d 22.4 atm

49. Calculate the percent dissociation of acetic acid in a solution containing 0.1M acetic acid and 0.5 M hydrochloroic acid. Ka=$1.8x10^{-5}$

a $3.6X10^{-}$
b $3.6x10^{-3}$
c $3.6x10^{-2}$
d $1.8x10^{-6}$

50. What is the normality of a MnO^{-} solution if 32.0 ml of the solution is required to titrate 40.0 ml of 0.4 N Fe^{2+}.

a 0.5 N
b 0.25 N
c 0.1 N
d 0.75 N

AMERICAN UNIVERSITY OF BEIRUT

DEPARTMENT OF CHEMISTRY

TABLE OF ATOMIC NUMBERS AND WEIGHTS

1971

ELEMENT	SYMBOL	ATOMIC NUMBER	ATOMIC WEIGHT (IUPAC)
Actinium	Ac	89	[227]
Aluminum	Al	13	26.9815
Americium	Am	95	[243]
Antimony	Sb	51	121.75
Argon	Ar	18	39.948
Arsenic	As	33	74.9216
Astatine	At	85	[210]
Barium	Ba	56	137.34
Berkelium	Bk	97	[247]
Beryllium	Be	4	9.0122
Bismuth	Bi	83	208.9804
Boron	B	5	10.81
Bromine	Br	35	79.904
Cadmium	Cd	48	112.40
Calcium	Ca	20	40.08
Californium	Cf	98	[249]
Carbon	C	6	12.011
Cerium	Ce	58	140.12
Cesium	Cs	55	132.9054
Chlorine	Cl	17	35.453
Chromium	Cr	24	51.996
Cobalt	Co	27	58.9332
Copper	Cu	29	63.546
Curium	Cm	96	[245]
Dysprosium	Dy	66	162.50
Einsteinium	Es	99	[249]
Erbium	Er	68	167.26
Europium	Eu	63	151.96
Fermium	Fm	100	[255]
Fluorine	F	9	18.9984
Francium	Fr	87	[223]
Gadolinium	Gd	64	157.25
Gallium	Ga	31	69.72
Germanium	Ge	32	72.59
Gold	Au	79	196.9665
Hafnium	Hf	72	178.49
Helium	He	2	4.0026
Holmium	Ho	67	164.9304
Hydrogen	H	1	1.00794
Indium	In	49	114.82
Iodine	I	53	126.9045
Iridium	Ir	77	192.22
Iron	Fe	26	55.847
Krypton	Kr	36	83.80
Lanthanum	La	57	138.9055
Lawrencium	Lr	103	[257]
Lead	Pb	82	207.2
Lithium	Li	3	6.941
Lutetium	Lu	71	174.97
Magnesium	Mg	12	24.305
Manganese	Mn	25	54.9380
Mendelevium	Md	101	[256]
Mercury	Hg	80	200.59
Molybdenum	Mo	42	95.94
Neodymium	Nd	60	144.24
Neon	Ne	10	20.179
Neptunium	Np	93	237.0482
Nickel	Ni	28	58.71
Niobium	Nb	41	92.9064
Nitrogen	N	7	14.0067
Nobelium	No	102	[254]
Osmium	Os	76	190.2
Oxygen	O	8	15.9994
Palladium	Pd	46	106.4
Phosphorus	P	15	30.9738
Platinum	Pt	78	195.09
Plutonium	Pu	94	[244]
Polonium	Po	84	[210]
Potassium	K	19	39.098
Praseodymium	Pr	59	140.9077
Promethium	Pm	61	[147]
Protactinium	Pa	91	231.0359
Radium	Ra	88	226.0254
Radon	Rn	86	[222]
Rhenium	Re	75	186.2
Rhodium	Rh	45	102.9055
Rubidium	Rb	37	85.4678
Ruthenium	Ru	44	101.07
Samarium	Sm	62	150.4
Scandium	Sc	21	44.9559
Selenium	Se	34	78.96
Silicon	Si	14	28.086
Silver	Ag	47	107.868
Sodium	Na	11	22.9898
Strontium	Sr	38	87.62
Sulfur	S	16	32.06
Tantalum	Ta	73	180.9479
Technetium	Tc	43	98.9062
Tellurium	Te	52	127.60
Terbium	Tb	65	158.9254
Thallium	Tl	81	204.37
Thorium	Th	90	232.0381
Thulium	Tm	69	168.9342
Tin	Sn	50	118.69
Titanium	Ti	22	47.90
Tungsten	W	74	183.85
Uranium	U	92	238.029
Vanadium	V	23	50.9414
Xenon	Xe	54	131.30
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.9059
Zinc	Zn	30	65.38
Zirconium	Zr	40	91.22