1. The percent by mass of oxygen in Na_2SO_4 (formula mass = 142) is closest to
   1) 11% 3) 45%
   2) 22% 4) 64%
2. Given the unbalanced equation:

   $$\_\_Al(s) + \_\_O_2(g) \rightarrow \_\_Al_2O_3(s)$$

   balance the equation using smallest whole number coefficients.
3. The percent by mass of aluminum in Al_2O_3 is approximately
   1) 18.9 3) 47.1
   2) 35.4 4) 52.9
4. What is the approximate percent composition by mass of $CaBr_2$ (formula mass = 200)?
   1) 20% calcium and 80% bromine
   2) 25% calcium and 75% bromine
   3) 30% calcium and 70% bromine
   4) 35% calcium and 65% bromine
5. What is the empirical formula for C_3H_6?
   1) CH
   2) CH_2
   3) CH_3
   4) CH_6
6. Which represents both an empirical and a molecular formula?
   1) P_2O_5
   2) N_2O_4
   3) C_3H_6
   4) $C_6H_{12}O_6$
7. The number of atoms in 2 grams of calcium is equal to
   1) $\frac{2 \times 6.02 \times 10^{23}}{40}$
   2) $\frac{40 \times 6.02 \times 10^{23}}{2}$
   3) $\frac{6.02 \times 10^{23}}{2 \times 40}$
   4) $2 \times 40 \times 6.02 \times 10^{23}$
8. At STP, 32 grams of O_2 would occupy the same volume as
   1) 64 g of H_2
   2) 32 g of SO_2
   3) 8.0 g of CH_4
   4) 4.0 g of He
9. Which compound has the empirical formula CH_2O?
   1) CH_3OH
   2) CH_3CH_2OH
   3) HCOOH
   4) CH_3COOH
10. Which list consists of types of chemical formulas?
    1) atoms, ions, molecules
    2) metals, nonmetals, metalloids
    3) empirical, molecular, structural
    4) synthesis, decomposition, neutralization
11. What is the total number of neon atoms contained in 20.2 grams of neon gas?
    1) 1.01×10^{24} 3) 3.01×10^{23}
    2) 2.02×10^{24} 4) 6.02×10^{23}
12. Given the balanced equation:

    $$X + Cl_2 \rightarrow C_2H_5Cl + HCl$$

    Which molecule is represented by *X*?
    1) C_2H_4
    2) C_2H_6
    3) C_3H_6
    4) C_3H_8
13. Which equation is correctly balanced?
    1) $H_2 + O_2 \rightarrow H_2O$ 3) $2\ H_2 + O_2 \rightarrow 2\ H_2O$
    2) $Ca + Cl_2 \rightarrow CaCl$ 4) $Ca + C1_2 \rightarrow Ca_2Cl$
14. Given the unbalanced equation:

    $$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

    Balance the equation using smallest whole number coefficients.

15. At STP, 25.0 liters of a gas has a mass of 50.0 grams. What is the gram molecular mass of the gas?
    1) 75.0 g
    2) 44.8 g
    3) 25.0 g
    4) 11.2 g
16. In which compound is the percent by mass of oxygen greatest?
    1) BeO
    2) MgO
    3) CaO
    4) SrO
17. What is the total mass of oxygen in 1.00 mole of $Al_2(CrO_4)_3$?
    1) 192 g
    2) 112 g
    3) 64.0 g
    4) 48.0 g
18. The percentage by mass of Br in the compound $AlBr_3$ is closest to
    1) 10.%
    2) 25%
    3) 75%
    4) 90.%
19. Given the unbalanced equation:

    $$\_C_3H_8(g) + \_O_2(g) \rightarrow \_H_2O(g) + \_CO_2(g)$$

    Balance the equation using smallest whole number coefficients.
20. In a laboratory experiment, a student determined the mass of the product, $NaNO_3(s)$, to be 0.105 grams.

    a. Calculate the gram formula mass of $NaNO_3(s)$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

    b. Calculate the number of moles of $NaNO_3(s)$ produced. [Show all work. Indicate the correct answer in proper significant figures.]

---

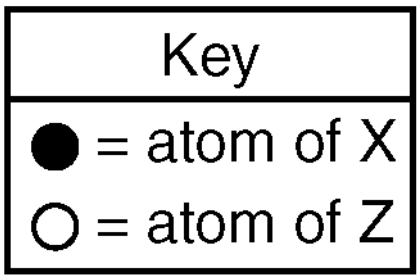
21. Which sample contains the same number of atoms as 24 grams of carbon?
    1) 80. g Ar
    2) 24 g Mg
    3) 10. g Ne
    4) 4.0 g He
22. Given the reaction:

    $$2\ NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2\ H_2O$$

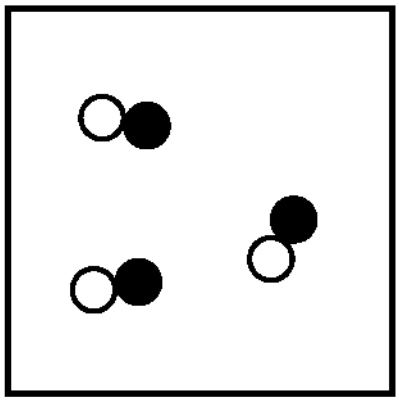
    What is the total number of moles of NaOH needed to react completely with 2 moles of H_2SO_4?
    1) 1
    2) 2
    3) 0.5
    4) 4
23. What is the total number of atoms represented in the formula $CuSO_4 \cdot 5H_2O$?
    1) 8
    2) 13
    3) 21
    4) 27
24. How many molecules are in 0.25 mole of O_2?
    1) 12×10^{23}
    2) 6.0×10^{23}
    3) 3.0×10^{23}
    4) 1.5×10^{23}
25. Which substance can be decomposed by a chemical change?
    1) Co
    2) CO
    3) Cr
    4) Cu
26. What is the total number of molecules of hydrogen in 0.25 mole of hydrogen?
    1) 6.0×10^{23}
    2) 4.5×10^{23}
    3) 3.0×10^{23}
    4) 1.5×10^{23}

27. What is the total number of moles of oxygen atoms in 1 mole of ozone? (Molecular mass = 48)
    1) 1
    2) 2
    3) 3
    4) 4
28. The percent by mass of calcium in the compound calcium sulfate ($CaSO_4$) is approximately
    1) 15%
    2) 29%
    3) 34%
    4) 47%
29. Which is an empirical formula?
    1) P_2O_5
    2) P_4O_6
    3) C_2H_4
    4) C_3H_6

30. Which particle diagram represents a mixture of element *X* and element *Z*, only?



1)



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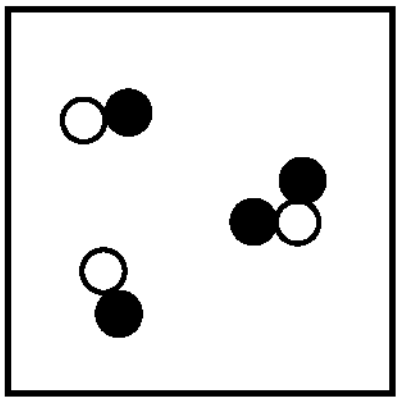

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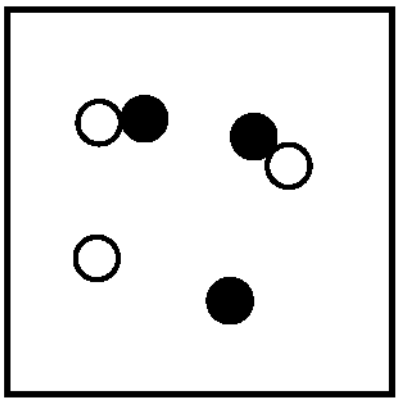
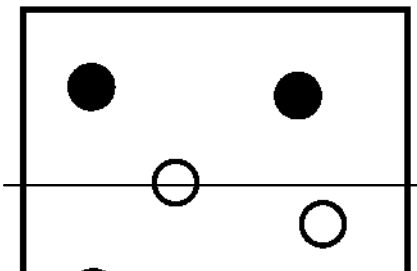


4)



31. $Cu(s) + 2\ HCl(aq) \leftrightarrow CuCl_2(aq) + H_2(g)$

What type of reaction is shown above?

1) synthesis
2) decomposition
3) single replacement
4) double replacement

32. Given the compound $C_4H_{10}O_8$,

a Calculate the molar masss of the compound.

b Calculate the number of moles in 17.7 grams of the compound.

c What is the empirical formula for this compound?

---

33. What is the gram formula mass of $Na_2CO_3 \cdot 10H_2O$?

1) 106 g
2) 142 g
3) 266 g
4) 286 g

34. Given the reaction:

$$2\ Al + 3\ H_2SO_4 \rightarrow 3\ H_2 + Al_2(SO_4)_3$$

The total number of moles of H_2SO_4 needed to react completely with 5.0 moles of Al is

1) 2.5 moles
2) 5.0 moles
3) 7.5 moles
4) 9.0 moles

35. Given the reaction:

$$C_6H_{12}O_6(s) + 6\ O_2(g) \rightarrow 6\ CO_2(g) + 6\ H_2O(\ell)$$

How many moles of $C_6H_{12}O_6(s)$ are needed to produce 24 moles of carbon dioxide?

1) 1.0 moles
2) 12 moles
3) 24 moles
4) 4.0 moles

36. Which substance has the greatest molecular mass?

1) H_2O_2
2) NO
3) CF_4
4) I_2

37. Given the equation:

$$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$$

If 8.0 moles of O_2 are completely consumed, what is the total number of moles of H_2O produced?

38. According to the reaction

$$H_2 + Cl_2 \rightarrow 2\ HCl,$$

the production of 2.0 moles of HCl would require 70. grams of Cl_2 and

1) 1.0 g of H_2
2) 2.0 g of H_2
3) 3.0 g of H_2
4) 4.0 g of H_2

39. A compound contains 57% sulfur and 43% oxygen by mass. What is the empirical formula of this compound?

1) SO
2) SO_2
3) SO_3
4) S_2O_3

40. Which quantity of helium may be represented by the symbol He?

1) 1 gram
2) 2 moles
3) 6×10^{23} atoms
4) 4 liters

41. Based on your reference tables, which compound could form a concentrated solution?

1) AgBr
2) AgCl
3) Ag_2CO_3
4) $AgNO_3$

42. When a battery is in use, stored chemical energy is first changed to
    1) electrical energy
    2) heat energy
    3) light energy
    4) mechanical energy

43. According to Reference Table F, which compound is most soluble in water?
    1) $BaCO_3$
    2) $BaSO_4$
    3) $ZnCO_3$
    4) $ZnSO_4$

44. When 200 grams of water cools from 50°C to 25°C, the total amount of heat energy released by the water is
    1) 10,000 calories
    2) 5,000 calories
    3) 8 calories
    4) 4 calories

45. A sample of pure water at 50.°C has a vapor pressure closest to
    1) 5.0 kPa
    2) 12 kPa
    3) 50 kPa
    4) 101.3 kPa

46. A sample of water is heated from 10ºC to 15ºC by the addition of 30. calories of heat. What is the mass of the water?
    1) 5.0 g
    2) 6.0 g
    3) 30. g
    4) 150 g

47. Which type of attraction results from the formation of weak momentary dipoles?
    1) ionic
    2) metallic
    3) molecule-ion
    4) van der Waals forces

48. A gas occupies a volume of 40.0 milliliters at 20°C. If the volume is increased to 80.0 milliliters at constant pressure, the resulting temperature will be equal to
    1) $20°C \times \frac{80.0mL}{40.0mL}$
    2) $20°C \times \frac{40.0mL}{80.0mL}$
    3) $293K \times \frac{80.0mL}{40.0mL}$
    4) $293K \times \frac{40.0mL}{80.0mL}$

49. At 25ºC, iodine exists as a solid and bromine as a liquid. This difference in phase is due to the presence of stronger
    1) covalent bonds in iodine
    2) covalent bonds in bromine
    3) van der Waals forces in iodine
    4) van der Waals forces in bromine

50. In which equation does the term "heat" represent heat of fusion?
    1) $NaCl(s) + heat \rightarrow NaCl(\ell)$
    2) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell) + heat$
    3) $H_2O(\ell) + heat \rightarrow H_2O(g)$
    4) $H_2O(\ell) + HCl(g) \rightarrow H_3O^+(aq) + Cl^-(aq) + heat$

51. As a solid is heated, its temperature increases from 10ºC to 25ºC, remains at 25ºC for 5 minutes, and then increases to beyond 45ºC. Based on this information, what conclusion can be drawn about the substance?
    1) Its melting point is 45ºC.
    2) Its boiling point is 45ºC.
    3) Its melting point is 25ºC.
    4) Its boiling point is 25ºC.

52. A student determined the mass, in grams, of compound *X* that would saturate 30. grams of water over a temperature range of 40.ºC in 10.-degree intervals. The results are tabulated below.

ams of Dissolved Compound *X*	T 30
2.0 g	
4.0 g	
8.0 g	
16 g	
32 g	

If this solubility trend continues total number of grams of compc dissolve in 30. grams of water a

1) 16
2) 32
3) 48
4) 64

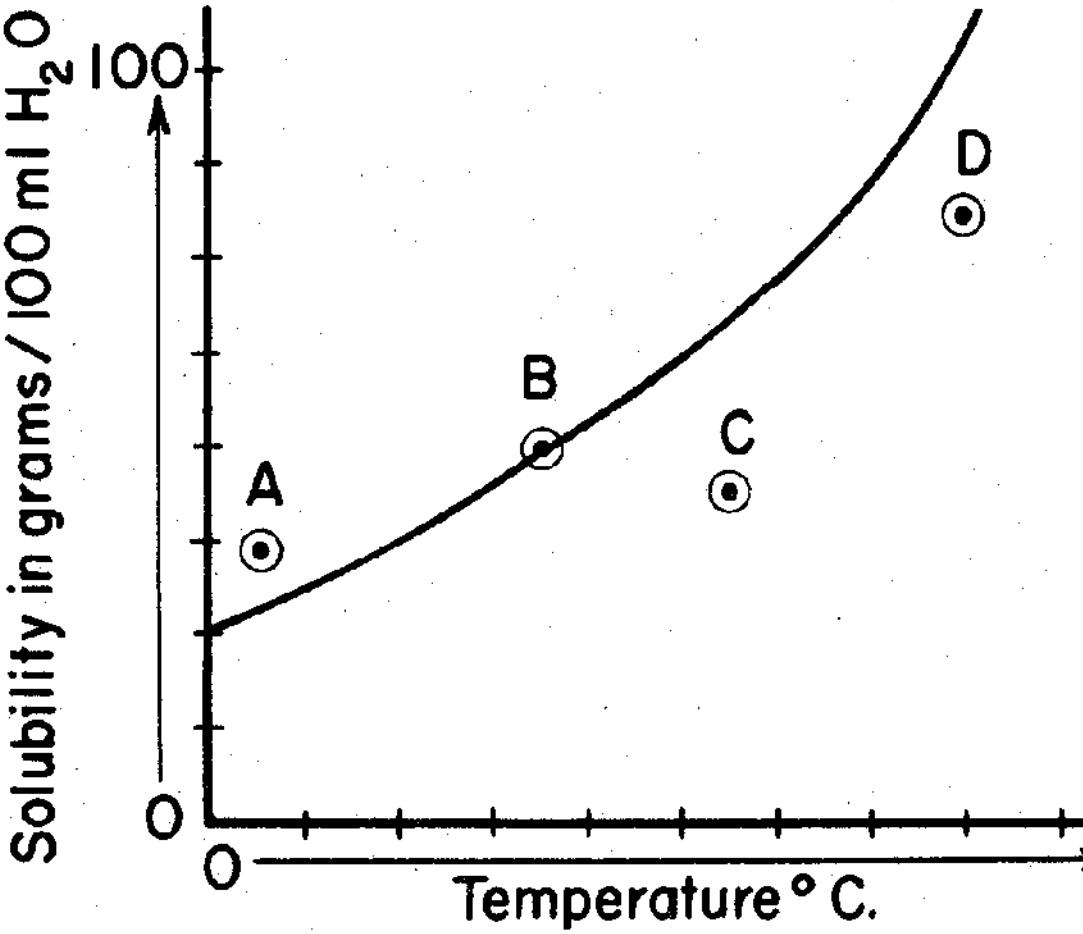
53. Which intermolecular force of a accounts for the relatively high water?

1) hydrogen bonding
2) covalent bonding
3) metallic bonding
4) ionic bonding

54. An unsaturated aqueous solution of NH_3 is at 90°C in 100. grams of water. According to Reference Table *G*, how many grams of NH_3 could this unsaturated solution contain?

1) 5 g
2) 10. g
3) 15 g
4) 20. g

55. Base your answer to the following question on the diagram below which represents the solubility curve of salt *X*. The four points on the diagram represent four solutions of salt *X*.



Which point represents the most concentrated solution of salt *X*?

1) *A*
2) *B*
3) *C*
4) *D*

56. When heat energy is lost by a pure substance at its freezing point, its potential energy

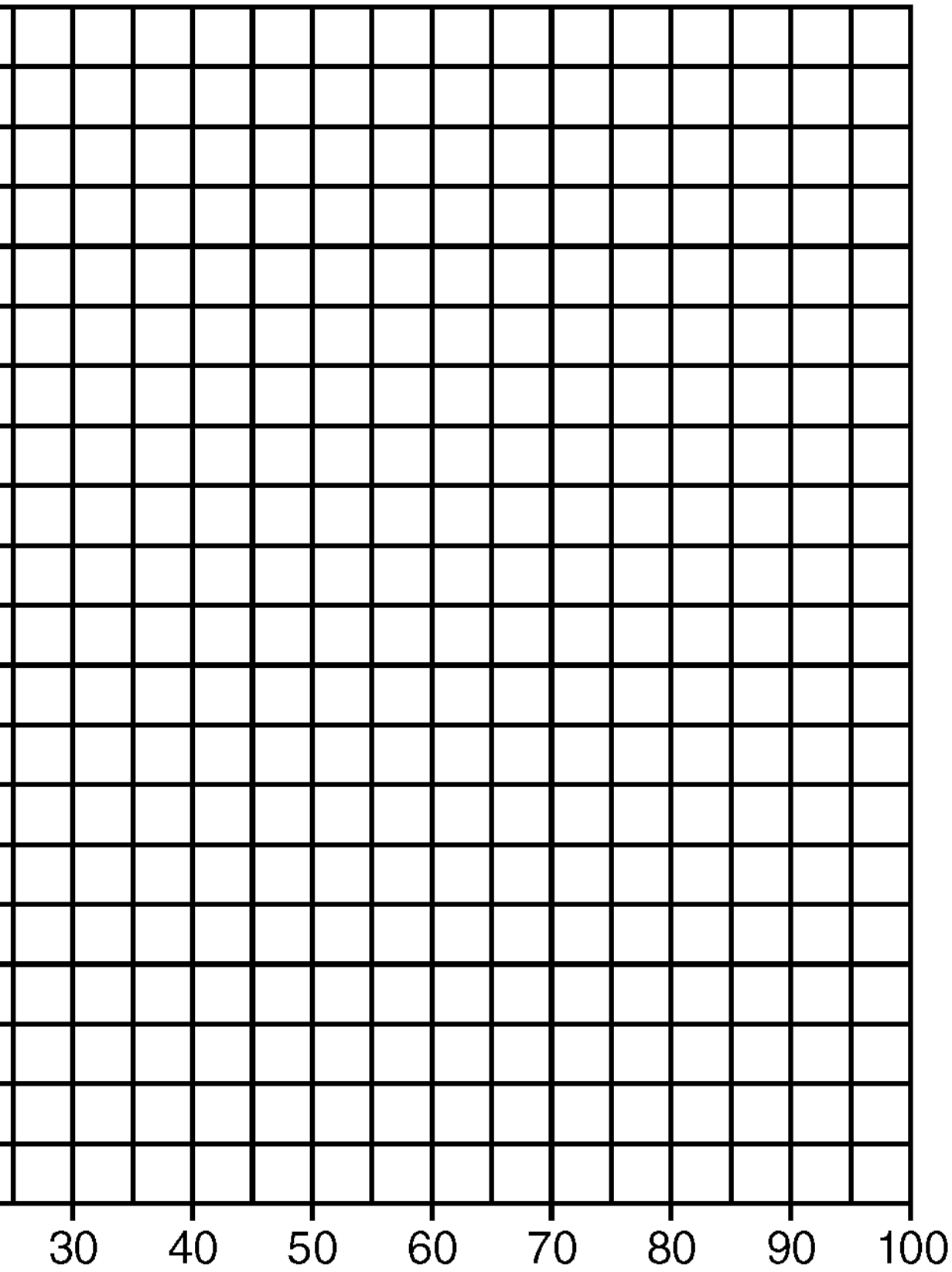
1) decreases
2) increases
3) remains the same

57. At STP, which of the following gases will diffuse most rapidly?

1) hydrogen
2) nitrogen
3) fluorine
4) oxygen

58. Base your answer to the following question on the data table below, which shows the solubility of a solid solute.

Solubility Curve



The Solub
Variou

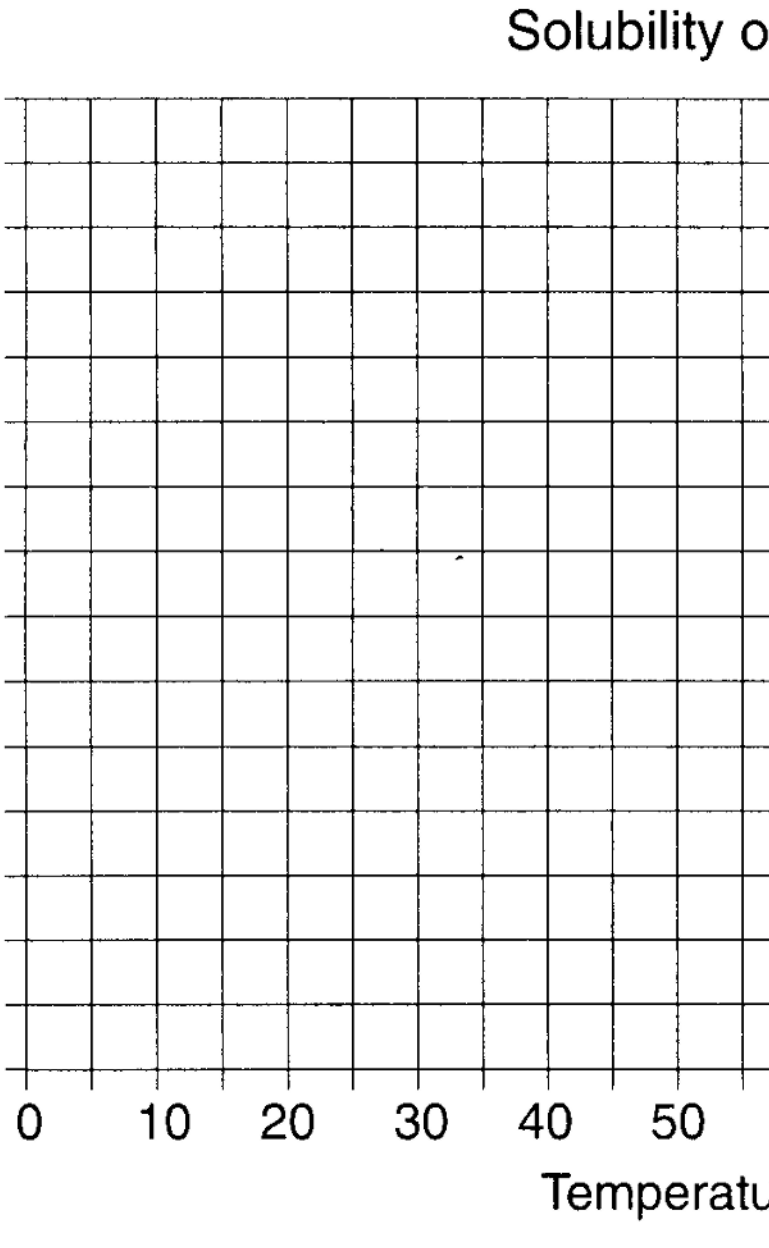
Tempera (°C)
0
20
40
60
80
100

On the same grid, plot the data from the data table. Circle and connect the points.

59. Which formula represents a homogeneous mixture?
    1) $H_2O(\ell)$
    2) $H_2S(g)$
    3) NaH(s)
    4) HCl(aq)
60. Hydrogen bonds are formed between molecules when hydrogen is covalently bonded to an element that has a
    1) small atomic radius and low electronegativity
    2) large atomic radius and low electronegativity
    3) small atomic radius and high electronegativity
    4) large atomic radius and high electronegativity

61. Given the data table below showing the solubility of salt *X*:

of Solute per 100 g of H_2O (g)
22
40.
48
107
135

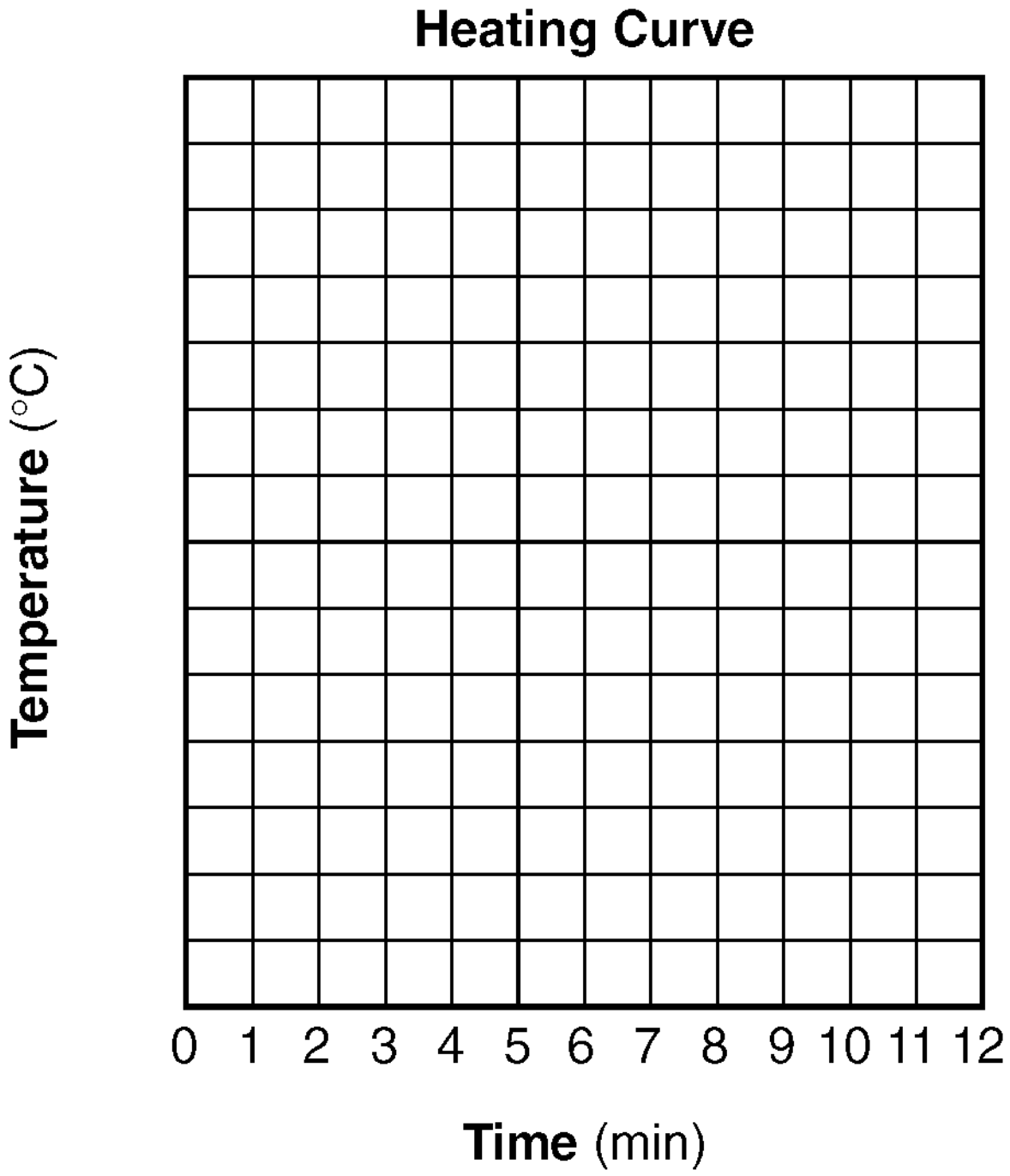


a Which salt on Table *G* is most likely to be salt *X*?
b Scale and label the y-axis including appropriate units.
c Plot the data from the data table. Surround each point with a small circle and draw a best-fit curve for the solubility of salt *X*.
d Using your graph, predict the solubility of salt *X* at 50ºC.
e If the pressure on the salt solution was increased, what effect would this pressure change have on the solubility of the salt?

62. Base your answer to the following question on the information below.

A substance is a solid at 15°C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

	0	1	2	3	4	5	6	7	8	9
(°C)	15	32	46	53	53	53	53	53	53	53



The heat of fusion for this substance is 122 joules per gram. How many joules of heat are needed to melt 7.50

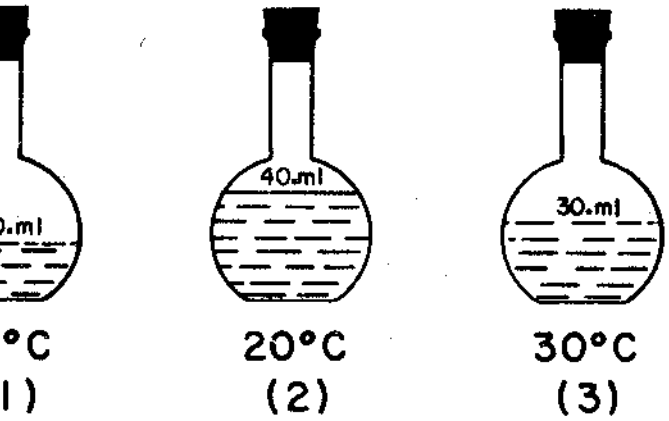
grams of this substance at its melting point?

63. At standard pressure when NaCl is added to water, the solution will have a
    1) higher freezing point and a lower boiling point than water
    2) higher freezing point and a higher boiling point than water
    3) lower freezing point and a higher boiling point than water
    4) lower freezing point and a lower boiling point than water
64. Which solution contains exactly 0.50 mole of H_2SO_4?
    1) 1.0 L of a 1.0 M solution
    2) 2.0 L of a 1.0 M solution
    3) 1.0 L of a 0.50 M solution
    4) 2.0 L of a 0.50 M solution
65. Based on Reference Table G, whicl solution could contain 42 grams of 100 grams of water at 40ºC?
    1) a saturated solution of $KClO_3$
    2) a saturated solution of KCl
    3) an unsaturated solution of NaCl
    4) an unsaturated solution of NH_4Cl
66. What is the minimum number of kiloJoules needed to change 40.0 grams of water at 100ºC to steam at the same temperature and pressure?
    1) 1,810
    2) 904
    3) 2.26
    4) .400
67. Based on Reference Table *F*, which of the following saturated solutions would be the *least* concentrated?
    1) sodium sulfate
    2) potassium sulfate
    3) copper (II) sulfate
    4) barium sulfate
68. Which substance will readily sublime at STP?
    1) Fe(s)
    2) $C_6H_{12}O_6(s)$
    3) NaCl(s)
    4) $CO_2(s)$
69. In an experiment using a calorimeter, the following data were obtained:

Mass of calorimeter + water 150
Mass of calorimeter 100
Final temperature of water. 55
Initial temperature of water 25

What is the total number of calories absorbed by the water?
    1) 1,000
    2) 1,500
    3) 3,000
    4) 4,500
70. A sample of glass is a supercooled liquid rather than a true solid because it has
    1) a definite volume
    2) no definite volume
    3) a crystalline structure
    4) no crystalline structure

71. Base your answer to the following question on the diagrams below of four sealed flasks, each of which contains $H_2O(\ell)$ at the temperature shown.



In which flask do the molecules of H_2O have the greatest average kinetic energy?

1) 1
2) 2
3) 3
4) 4

72. The process of separating petroleum into components based on differences in their boiling points is called
1) cracking
2) hydrogenation
3) destructive distillation
4) fractional distillation

73. Which sample of Fe contains particles having the highest average kinetic energy?
1) 5 g at 10ºC
2) 10 g at 25ºC
3) 5 g at 400 K
4) 10 g at 300 K

74. Which phase change is endothermic?
1) $H_2O(\ell) \rightarrow H_2O(g)$
2) $I_2(g) \rightarrow I_2(s)$
3) $Hg(\ell) \rightarrow Hg(s)$
4) $H_2S(g) \rightarrow H_2S(\ell)$

75. As the space between molecules in a gas sample decreases, the tendency for the behavior of this gas to deviate from the ideal gas laws
1) decreases
2) increases
3) remains the same

76. Which compound has a high melting point?
1) SiO_2
2) CO_2
3) SO_2
4) NO_2

77. Under which conditions does a real gas behave most like an ideal gas?
1) at low temperatures and high pressures
2) at low temperatures and low pressures
3) at high temperatures and high pressures
4) at high temperatures and low pressures

78. Under the same conditions of temperature and pressure, which gas will diffuse at the *slowest* rate?
1) He
2) Ne
3) Ar
4) Rn

79. What is the molarity of a solution of NaOH if 2 liters of the solution contains 4 moles of NaOH?
1) 0.5 M
2) 2 M
3) 8 M
4) 80 M

80. The average kinetic energy of water molecules increases when
1) $H_2O(s)$ changes to $H_2O(\ell)$ at 0ºC
2) $H_2O(\ell)$ changes to $H_2O(s)$ at 0ºC
3) $H_2O(\ell)$ at 10ºC changes to $H_2O(\ell)$ at 20ºC
4) $H_2O(\ell)$ at 20ºC changes to $H_2O(\ell)$ at 10ºC

81. When 1.255 grams of *X* reacts completely with 3.2 grams of *Y*, *Z* is the only product of the reaction. What is the total mass of *Z*, expressed to the proper number of significant figures?
1) 4.455 g
2) 4.46 g
3) 4.5 g
4) 5 g

82. In a laboratory experiment, the melting point of compound *A* was determined to be 82.6ºC. If the accepted value is 80.5ºC, what is the percent error in this determination? (Show proper significant figures)
1) 2.5
2) 2.54
3) 2.6
4) 2.71

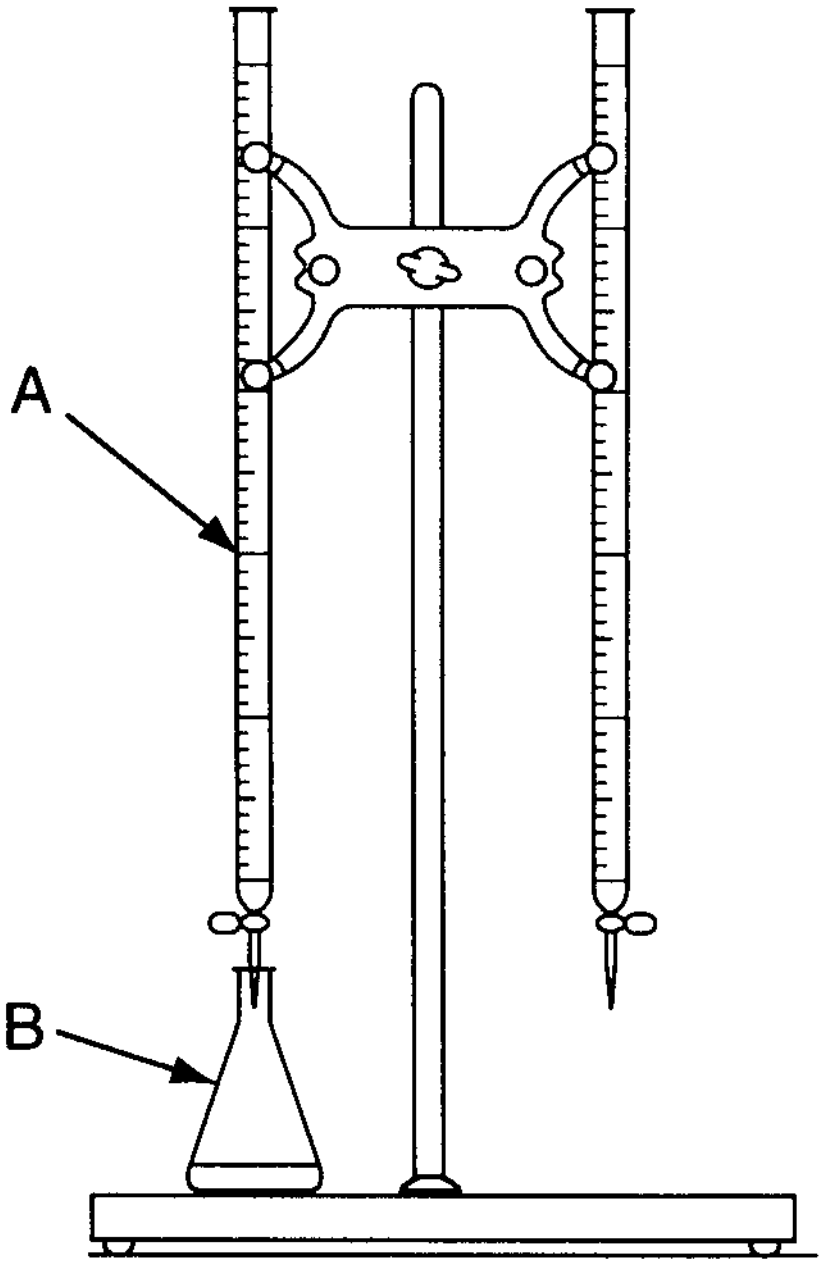
83. One kiloJoule is the same as
1) 0.001 Joule
2) 0.01 Joule
3) 100 Joules
4) 1,000 Joules

84. Which kelvin temperature is equivalent to –24ºC?
    1) 226 K
    2) 249 K
    3) 273 K
    4) 297 K

85. In a laboratory exercise, 0.03 grams of magnesium metal reacts with excess dilute hydrochloric acid. The hydrogen gas produce is to be collected and its volume measured. Which device would be most suitable to measure the volume of the hydrogen gas collected?
    1) Erlenmeyer flask
    2) volumetric flask
    3) beaker
    4) eudiometer tube

86. Which quantity is equivalent to 50 kiloJoules
    1) 5000 J
    2) 0.05 J
    3) 5×10^3 J
    4) 5×10^4 J

87. The diagram below shows a laboratory setup that can be used in a titration.



Which pieces of equipment are indicated by arrows *A* and *B*, respectively?
1) buret and Erlenmeyer flask
2) buret and volumetric flask
3) pipet and Erlenmeyer flask
4) pipet and volumetric flask

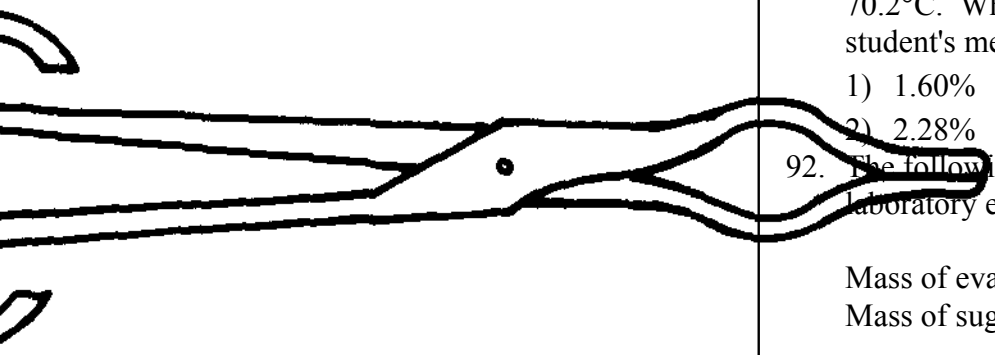
88. Using a triple beam balance and a graduated cylinder, a student collected data on a sample of an element:

Mass of sample –	10.9 g
Volume of water –	30.0 ml
Volume of water and sample –	34.0 ml

a) Calculate the density of the sample. Show all work and use significant figures and units.

b) Based on Reference Table S, what element might the sample be?

89. Which piece of laboratory equipment is represented by the diagram below?



1) crucible tongs
2) beaker tongs
3) test tube clamp
4) pinch clamp

90. What is the sum of 0.0421 g + 5.263 g + 2.13 g to the correct number of significant digits?

1) 7 g
2) 7.4 g
3) 7.44 g
4) 7.435 g

91. A student in a laboratory determined the boiling point of a substance to be 71.8°C. The accepted value for the boiling point of this substance is 70.2°C. What is the percent error of the student's measurement?

1) 1.60%
2) 2.28%
3) 2.23%
4) 160.%

92. The following weighings were made during a laboratory exercise:

Mass of evaporating dish.....59.260 g
Mass of sugar sample .....1.61 g

What is the total mass of the evaporating dish plus the sample, expressed to the proper number of significant figures?

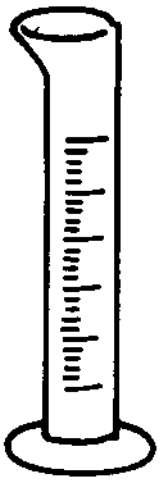
1) 60.870 g
2) 60.87 g
3) 60.9 g
4) 61 g

93. In an experiment the gram atomic mass of magnesium was determined to be 24.7. Compared to the accepted value 24.3, the percent error for this determination was

1) 0.400
2) 1.65
3) 24.7
4) 98.4

94. Which diagram represents a graduated cylinder?

1)



3)

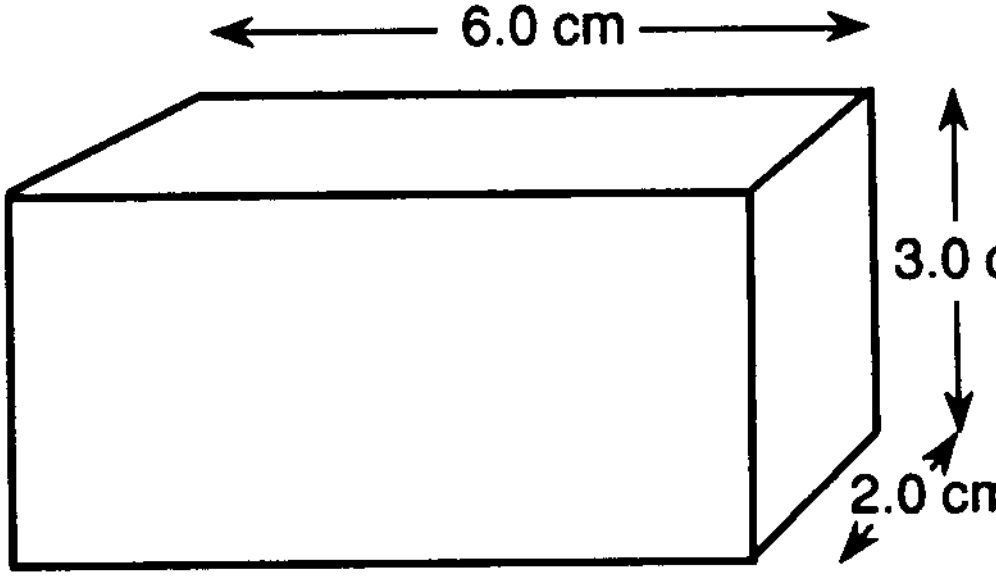
2)

4)

95. The accepted value for the molar volume of a gas is 22.4 liters. In a laboratory experiment, a student determines the value to be 24.8 liters. What is the percent error of the student's measurement?

1) 0.120%
2) 0.107%
3) 10.7%
4) 12.0%

96. The solid object shown below has a mass of 162.2 grams.



What is the density of the object to the correct number of significant figures?

1) 0.22 g/cm^3
2) 0.2219 g/cm^3
3) 4.5 g/cm^3
4) 4.505 g/cm^3

97. Expressed to the correct number of significant figures, the sum of two masses is 445.2 grams. Which two masses produce this answer?

1) 210.10 g + 235.100 g
2) 210.100 g + 235.10 g
3) 210.1 g + 235.1 g
4) 210.10 g + 235.10 g

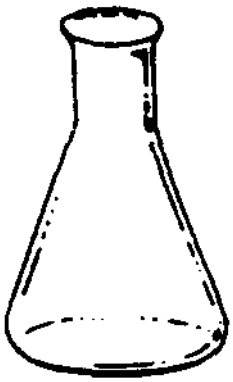
98. What is the safest method for diluting concentrated sulfuric acid with water?

1) add the acid to the water quickly
2) add the water to the acid quickly
3) add the acid to the water slowly while stirring
4) add the water to the acid slowly while stirring

99. Which diagram represents a crucible?

1)

2)



3)

4)

100. A Bunsen burner flame is sooty black and mixed with an orange-yellow color. Which is the probable reason for this condition?

1) No oxygen is mixing with the gas.
2) No gas is mixing with the oxygen.
3) Insufficient oxygen is mixing with the gas.
4) Insufficient gas is mixing with the oxygen.

Reference Tables

Table S
Properties of Selected Elements

Atomic Number	Symbol	Name	Ionization Energy (kJ/mol)	Electro-negativity	Melting Point (K)	Boiling Point (K)	Density** (g/cm^3)	Atomic Radius (pm)
1	H	hydrogen	1312	2.1	14	20	0.00009	208
2	He	helium	2372	—	1	4	0.000179	50
3	Li	lithium	520	1.0	454	1620	0.534	155
4	Be	beryllium	900	1.6	1551	3243	1.8477	112
5	B	boron	801	2.0	2573	3931	2.340	98
6	C	carbon	1086	2.6	3820	5100	3.513	91
7	N	nitrogen	1402	3.0	63	77	0.00125	92
8	O	oxygen	1314	3.4	55	90	0.001429	65
9	F	fluorine	1681	4.0	54	85	0.001696	57
10	Ne	neon	2081	—	24	27	0.0009	51
11	Na	sodium	496	0.9	371	1156	0.971	190
12	Mg	magnesium	736	1.3	922	1363	1.738	160
13	Al	aluminum	578	1.6	934	2740	2.698	143
14	Si	silicon	787	1.9	1683	2628	2.329	132
15	P	phosphorus	1012	2.2	44	553	1.820	128
16	S	sulfur	1000	2.6	386	718	2.070	127
17	Cl	chlorine	1251	3.2	172	239	0.003214	97
18	Ar	argon	1521	—	84	87	0.001783	88
19	K	potassium	419	0.8	337	1047	0.862	235
20	Ca	calcium	590	1.0	1112	1757	1.550	197
21	Sc	scandium	633	1.4	1814	3104	2.989	162
22	Ti	titanium	659	1.5	1933	3580	4.540	145
23	V	vanadium	651	1.6	2160	3650	6.100	134
24	Cr	chromium	653	1.7	2130	2945	7.190	130
25	Mn	manganese	717	1.6	1517	2235	7.440	135
26	Fe	iron	762	1.8	1808	3023	7.874	126
27	Co	cobalt	760	1.9	1768	3143	8.900	125
28	Ni	nickel	737	1.9	1726	3005	8.902	124
29	Cu	copper	745	1.9	1357	2840	8.960	128
30	Zn	zinc	906	1.7	693	1180	7.133	138
31	Ga	gallium	579	1.8	303	2676	5.907	141
32	Ge	germanium	762	2.0	1211	3103	5.323	137
33	As	arsenic	944	2.2	1090	889	5.780	139
34	Se	selenium	941	2.6	490	958	4.790	140
35	Br	bromine	1140	3.0	266	332	3.122	112
36	Kr	krypton	1351	—	117	121	0.00375	103
37	Rb	rubidium	403	0.8	312	961	1.532	248
38	Sr	strontium	549	1.0	1042	1657	2.540	215
39	Y	yttrium	600	1.2	1795	3611	4.469	178
40	Zr	zirconium	640	1.3	2125	4650	6.506	160

Reference Tables

Table E
Selected Polyatomic Ions

H_3O^+	hydronium	CrO_4^{2-}	chromate
Hg_2^{2+}	dimercury (I)	$Cr_2O_7^{2-}$	dichromate
NH_4^+	ammonium	MnO_4^-	permanganate
$C_2H_3O_2^-$ / CH_3COO^-	acetate	NO_2^-	nitrite
CN^-	cyanide	NO_3^-	nitrate
CO_3^{2-}	carbonate	O_2^{2-}	peroxide
HCO_3^-	hydrogen carbonate	OH^-	hydroxide
$C_2O_4^{2-}$	oxalate	PO_4^{3-}	phosphate
ClO^-	hypochlorite	SCN^-	thiocyanate
ClO_2^-	chlorite	SO_3^{2-}	sulfite
ClO_3^-	chlorate	SO_4^{2-}	sulfate
ClO_4^-	perchlorate	HSO_4^-	hydrogen sulfate
		$S_2O_3^{2-}$	thiosulfate

Reference Tables

Heat of Fusion	333.6 J/g
Heat of Vaporization	2259 J/g
Specific Heat Capacity of H_2O (ℓ)	4.2 J/g•K

Reference Tables

Symbol	Name	Quantity
m	meter	length
kg	kilogram	mass
Pa	pascal	pressure
K	kelvin	temperature
mol	mole	amount of substance
J	joule	energy, work, quantity of heat
s	second	time
L	liter	volume
ppm	part per million	concentration
M	molarity	solution concentration

Quarter 1 Midterm Review
Answer Key

1. 3

2. _4_Al(s) + _3_O_2(g) → _2_Al_2O_3(s)

3. 4

4. 1

5. 2

6. 1

7. 1

8. 4

9. 4

10. 3

11. 4

12. 2

13. 3

14. _1_$Al_2(SO_4)_3$ + _3_$Ca(OH)_2$ → _2_$Al(OH)_3$ + _3_$CaSO_4$

15. 2

16. 1

17. 1

18. 4

19. _1_C_3H_8(g) + _5_O_2(g) → _4_H_2O(g) + _3_CO_2(g)

20. a) 23.0 + 14.0 + 3(16.0) = 85.0 g b) 0.105g *x* 1.00 mole/85.0g = 0.00124 mole

21. 1

22. 4

23. 3

24. 4

25. 2

26. 4

27. 3

28. 2

29. 1

30. 4

31. 3

32. a) 186 grams b) .095 moles c) $C_2H_5O_4$

33. 4

34. 3

35. 4

36. 4

37. 16 *or* 16.0

38. 2

39. 4

40. 3

41. 4

42. 1

43. 4

44. 2

45. 2

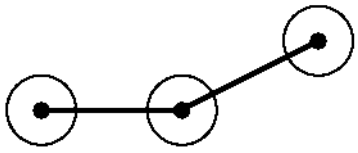
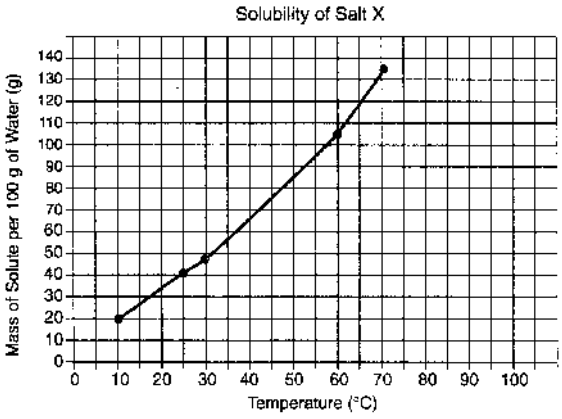
46. 2

47. 4

48. 3

49. 3

Quarter 1 Midterm Review
Answer Key

50. 1
51. 3
52. 4
53. 1
54. 1
55. 4
56. 1
57. 1
58. Example: 
59. 4
60. 3
61. 

a) potassium nitrate (KNO_3). *b)* Appropriate units include, but are not limited to, these examples: – mass of solute per 100 g of H_2O(g) *or* – grams solute (g) *or* – mass solute (g) *c)* graph *d)* 85 grams *e)* no effect on the solubility of the salt.
62. 915 J
63. 3
64. 3
65. 4
66. 2
67. 4
68. 4
69. 2
70. 4
71. 4
72. 4
73. 3
74. 1
75. 2
76. 1
77. 4
78. 4
79. 2
80. 3
81. 3
82. 3
83. 4
84. 2
85. 4
86. 4
87. 1
88. a) 2.7 g/ml b) Al

Quarter 1 Midterm Review
Answer Key

89. 1

90. 3

91. 2

92. 2

93. 2

94. 1

95. 3

96. 3

97. 3

98. 3

99. 3

100. 3