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Chemistry Lab

Exam

Booklet

STOUT
UNIVERSITY OF WISCONSIN
WISCONSIN'S POLYTECHNIC UNIVERSITY

March 16th, 2019

State Tournament

University of Wisconsin - Stout

Instructions: This exam consists of an acid-base experiment worth 100 points, a physical properties experiment worth 100 points, and a multiple choice exam worth 100 points (300 points total). Students may NOT write on the Experiment or Exam Booklet. Students may **only mark on their answer sheets. Acid Base Questions 1 to 50, Physical Properties Questions 51 to 100.**

Multiple choice questions are scored as:

Number Correct – 0.2 (Number Incorrect)

As a result, you will **not receive any credit for randomly guessing answers** to the questions.

Be strategic, figure out the way that you and your team can bank as many points as possible in the time given. Place the answers to the lab experiments and multiple choice exam on the provided answer sheets. Answers not placed on the answer sheet will not be scored.

Ties will be broken by first the quality, accuracy, and completeness of the **acid-base experimental data**, followed by the quality, accuracy, and completeness of the **physical properties experimental data**.

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Potentially Useful Information:

$$C_1 \cdot V_1 = C_2 \cdot V_2$$

$$pH = -\log [H_3O^+]$$

TABLE 3.2 Common Acids and Bases

Strong Acids (Strong Electrolytes)		Soluble Strong Bases	
HCl (aq)	Hydrochloric acid	LiOH	Lithium hydroxide
HBr (aq)	Hydrobromic acid	NaOH	Sodium hydroxide
HI (aq)	Hydroiodic acid	KOH	Potassium hydroxide
HNO_3	Nitric acid	$Ba(OH)_2$	Barium hydroxide
$HClO_4$	Perchloric acid		
H_2SO_4	Sulfuric acid		
Weak Acids (Weak Electrolytes)*		**Weak Base (Weak Electrolyte)**	
H_3PO_4	Phosphoric acid	NH_3	Ammonia
H_2CO_3	Carbonic acid		
CH_3CO_2H	Acetic acid		
$H_2C_2O_4$	Oxalic acid		
$H_2C_4H_4O_6$	Tartaric acid		
$H_3C_6H_5O_7$	Citric acid		
$HC_9H_8O_4$	Aspirin		

* These are representative of hundreds of weak acids.

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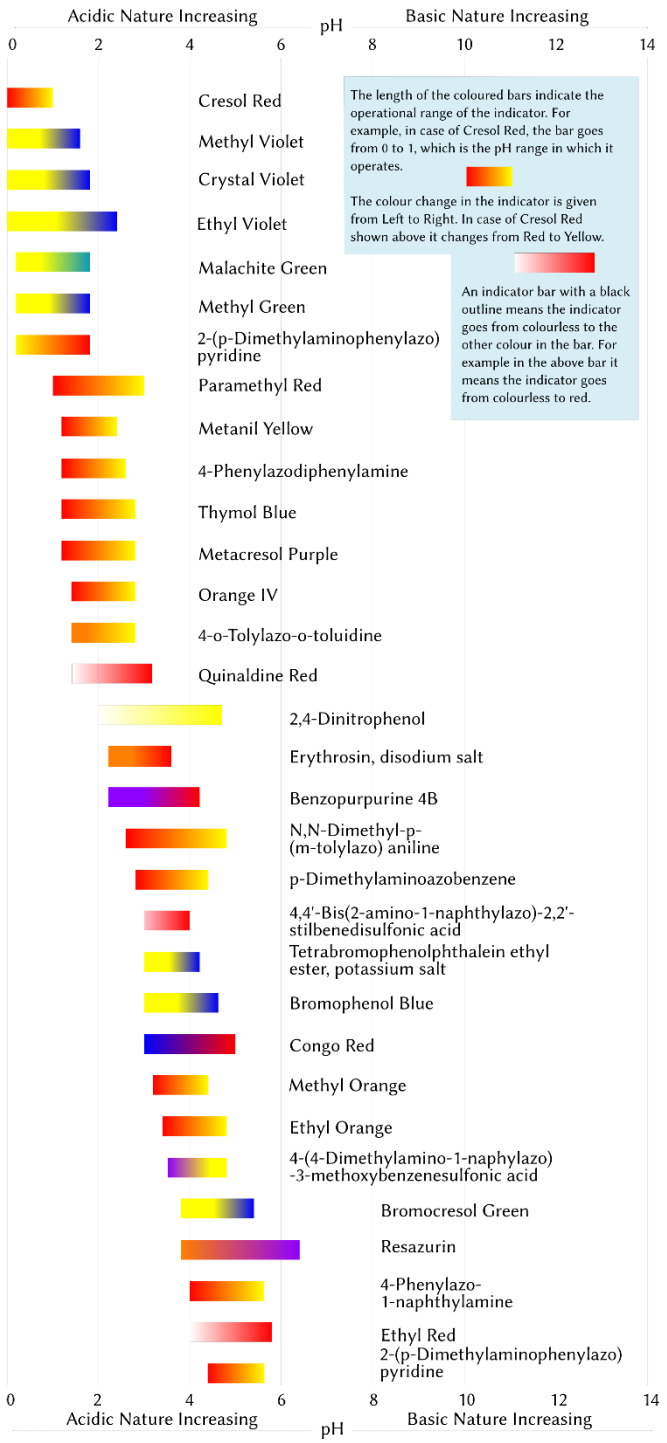
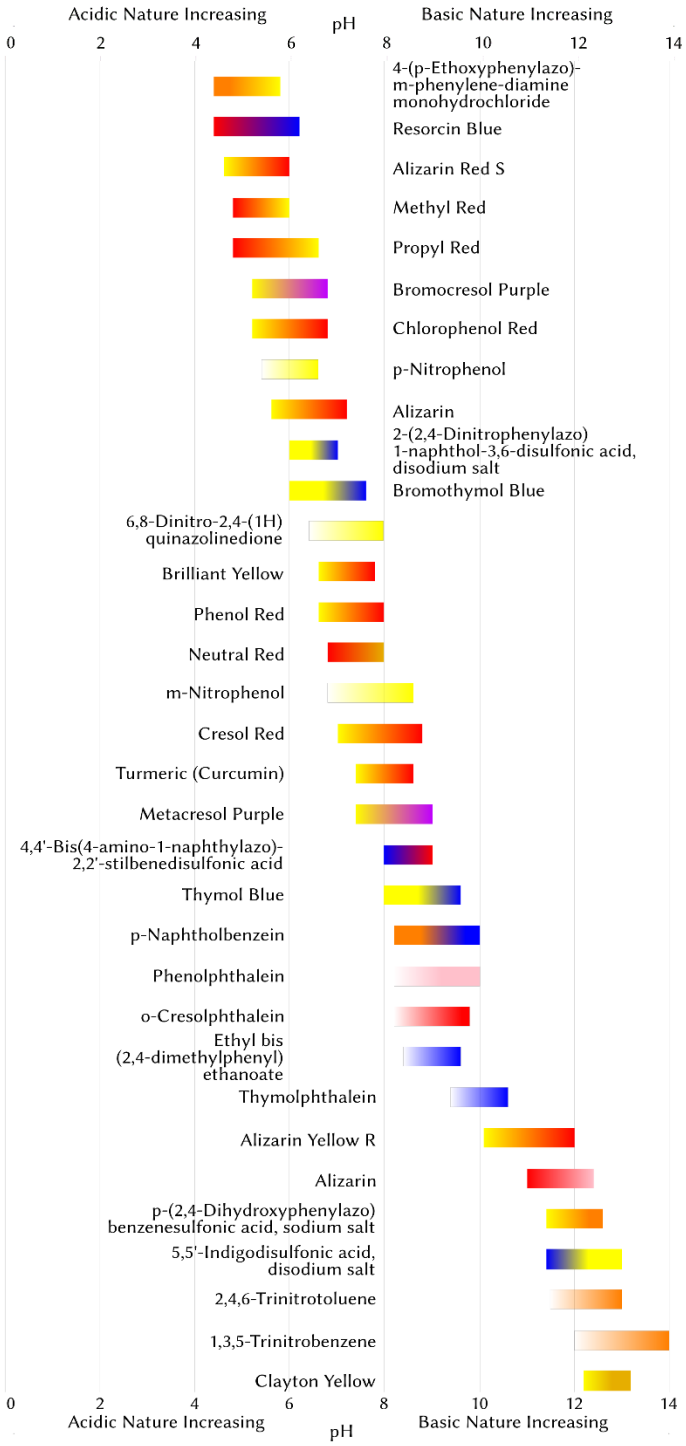
A Chart of Acid-Base Indicators showing their range and colour change





Data Source: CRC Handbook of Chemistry and Physics 84th Edition.

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MULTIPLE CHOICE EXAM (100 Points)

Multiple Choice Answers must be placed on Answer Sheet provided.

Multiple Choice is scored as:

Number Correct – 0.2 (Number Incorrect)

ACID BASE CHEMISTRY

1. What volume (mL) of 0.135 M NaOH is required to neutralize 13.7 mL of 0.129 M HCl?
A) 13.1
B) 0.24
C) 14.3
D) 0.076
E) 6.55

2. What volume (L) of 0.250 M HNO_3 is required to neutralize a solution prepared by dissolving 17.5 g of NaOH in 350 mL of water?
A) 50.0
B) 0.44
C) 1.75
D) 0.070
E) 1.75×10^{-3}

3. An aliquot (28.7 mL) of a KOH solution required 31.3 mL of 0.118 M HCl for neutralization. What mass (g) of KOH was in the original sample?
A) 1.64
B) 7.28
C) 0.173
D) 0.207
E) 0.414

4. The point in a titration at which the indicator changes is called the _____.
A) setpoint
B) indicator point
C) standard point
D) endpoint
E) volumetric point

5. Which of the following would require the largest volume of 0.100 M sodium hydroxide solution for neutralization?
A) 10.0 mL of 0.0500 M phosphoric acid
B) 20.0 mL of 0.0500 M nitric acid
C) 5.0 mL of 0.0100 M sulfuric acid
D) 15.0 mL of 0.0500 M hydrobromic acid
E) 10.0 mL of 0.0500 M perchloric acid

6. A 36.3 mL aliquot of 0.0529 M H_2SO_4 (aq) is to be titrated with 0.0411 M NaOH (aq). What volume (mL) of base will it take to reach the equivalence point?

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A) 93.4
B) 46.7
C) 187
D) 1.92
E) 3.84

7. A 13.8 mL aliquot of 0.176 M H_3PO_4 (aq) is to be titrated with 0.110 M NaOH (aq). What volume (mL) of base will it take to reach the equivalence point?

A) 7.29
B) 22.1
C) 199
D) 66.2
E) 20.9

8. What volume (mL) of 7.48×10^{-2} M perchloric acid can be neutralized with 115 mL of 0.244 M sodium hydroxide?

A) 125
B) 8.60
C) 188
D) 750
E) 375

9. What volume (mL) of 7.48×10^{-2} M phosphoric acid can be neutralized with 115 mL of 0.244 M sodium hydroxide?

A) 125
B) 375
C) 750
D) 188
E) 75.0

10. In a titration of 35.00 mL of 0.737 M H_2SO_4, _____ mL of a 0.827 M KOH solution is required for neutralization.

A) 35.0
B) 1.12
C) 25.8
D) 62.4
E) 39.3

11. Oxalic acid is a diprotic acid. Calculate the percent of oxalic acid ($H_2C_2O_4$) in a solid given that a 0.7984-g sample of that solid required 37.98 mL of 0.2283 M NaOH for neutralization.

A) 48.89
B) 97.78
C) 28.59
D) 1.086
E) 22.83

12. Oxalic acid is a diprotic acid. If a solid material contains 53.66 percent of oxalic acid ($H_2C_2O_4$), by mass, then a 0.6543-g sample of that solid will require _____ mL of 0.3483 M NaOH for neutralization.

A) 11.19
B) 97.78
C) 28.59
D) 1.119
E) 22.39

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13. A mass of 0.4113 g of an unknown acid, HA, is titrated with NaOH. If the acid reacts with 28.10 mL of 0.1055 M NaOH(aq), what is the molar mass of the acid?

a) 2.965 × 10-3 g/mol
b) 9.128 g/mol
c) 138.7 g/mol
d) 337.3 g/mol
e) 820.7 g/mol

14. Each of the following mixtures can produce an effective buffer solution EXCEPT

a) HCl and KCl.
b) Na_2HPO_4 and Na_3PO_4.
c) $NaHCO_3$ and Na_2CO_3.
d) NaH_2PO_4 and Na_2HPO_4.
e) HF and NaF.

15. Which one of the following conditions is always true for a titration of a weak acid with a strong base?

a) A colored indicator with a pKa less than 7 should be used.
b) If a colored indicator is used, it must change color rapidly in the weak acid's buffer region.
c) Equal volumes of weak acid and strong base are required to reach the equivalence point.
d) The equivalence point occurs at a pH equal to 7.
e) The equivalence point occurs at a pH greater than 7.

16. Which is the best colored indicator to use in the titration of 0.005 M HClO(aq) with NaOH(aq)? Why? (Ka of HClO = 3.5 × 10-8, Kb of ClO^- = 2.9 × 10-7)

Indicator	pKa
Thymol Blue	2.0
Phenol Red	7.5
Phenolphthalein	9.2

a) Thymol Blue. The equivalence point for a weak acid titration occurs at low pH.
b) Phenol Red. The pH at the equivalence point is 7.0.
c) Phenol Red. The pKa of HClO and the pKa of the indicator are similar.
d) Phenolphthalein. The pKa of ClO^- and the pKb of the indicator are similar.
e) Phenolphthalein. The pH at the equivalence point is near the pKa of the indicator.

17. What color change is exhibited by phenolphthalein during a titration of aqueous acetic acid with aqueous sodium hydroxide?

a) colorless to pink
b) pink to colorless
c) green to yellow
d) yellow to blue
e) blue to yellow

18. Of the following solutions, which has the greatest buffering capacity?

A) 0.821 M HF and 0.217 M NaF
B) 0.821 M HF and 0.909 M NaF
C) 0.100 M HF and 0.217 M NaF
D) 0.121 M HF and 0.667 M NaF
E) They are all buffer solutions and would all have the same capacity.

19. Of the following solutions, which has the greatest buffering capacity?

A) 0.543 M NH_3 and 0.555 M NH_4Cl
B) 0.087 M NH_3 and 0.088 M NH_4Cl
C) 0.234 M NH_3 and 0.100 M NH_4Cl
D) 0.100 M NH_3 and 0.455 M NH_4Cl
E) They are all buffer solutions and would all have the same capacity.

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20. The addition of hydrofluoric acid and _____ to water produces a buffer solution.
A) HCl
B) $NaNO_3$
C) NaF
D) NaCl
E) NaBr

21. The addition of hydrochloric acid and _____ to water produces a buffer solution.
A) HC_6H_5O
B) NaOH
C) NH_3
D) HNO_3
E) $NaNO_3$

22. The addition of sodium hydroxide and _____ to water produces a buffer solution.
A) HCl
B) $NaC_2H_3O_2$
C) NaF
D) NH_3
E) none of the above

23. Which of the following could be added to a solution of potassium fluoride to prepare a buffer?
A) sodium hydroxide
B) potassium acetate
C) hydrochloric acid
D) sodium fluoride
E) ammonia

24. Which of the following could be added to a solution of acetic acid to prepare a buffer?
A) sodium hydroxide
B) hydrochloric acid
C) nitric acid
D) more acetic acid
E) None of the above can be added to an acetic acid solution to prepare a buffer.

25. The primary buffer system that controls the pH of the blood is the _____ buffer system.
A) carbon dioxide, carbonate
B) carbonate, bicarbonate
C) carbonic acid, carbon dioxide
D) carbonate, carbonic acid
E) carbonic acid, bicarbonate

26. What are the principal organs that regulate the pH of the carbonic acid-bicarbonate buffer system in the blood?
A) kidneys, liver
B) lungs, kidneys
C) spleen, liver
D) lungs, skin
E) brain stem, heart

27. Human blood is _____.
A) neutral
B) very basic
C) slightly acidic
D) very acidic
E) slightly basic

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28. A 25.0 mL sample of a solution of an unknown compound is titrated with a 0.115 M NaOH solution. The titration curve above was obtained. The unknown compound is _____.

A) a strong acid
B) a strong base
C) a weak acid
D) a weak base
E) neither an acid nor a base

29. A 25.0 mL sample of a solution of a monoprotic acid is titrated with a 0.115 M NaOH solution. The titration curve above was obtained. The concentration of the monoprotic acid is about _____ mol/L.

A) 25.0
B) 0.0600
C) 0.240
D) 0.120
E) 0.100

30. A 25.0 mL sample of a solution of a monoprotic acid is titrated with a 0.115 M NaOH solution. The titration curve above was obtained. Which of the following indicators would be best for this titration?

A) methyl red
B) bromthymol blue
C) thymol blue
D) phenolpthalein
E) bromocresol purple

31. The pH of a solution prepared by mixing 50.0 mL of 0.125 M NaOH and 40.0 mL of 0.125 M HNO_3 is _____.

A) 13.29
B) 7.00
C) 8.11
D) 11.00
E) none of the above

32. A 50.0 mL sample of an aqueous H_2SO_4 solution is titrated with a 0.375 M NaOH solution. The equivalence point is reached with 62.5 mL of the base. The concentration of H_2SO_4 is _____ M.

A) 0.234
B) 0.469
C) 0.150
D) 0.300
E) 0.938

33. Calculate the pH of a solution that is 0.295 M in sodium formate ($NaHCO_2$) and 0.205 M in formic acid (HCO_2H). The K_a of formic acid is 1.77×10^{-4}.

A) 3.910
B) 3.587
C) 13.84
D) 10.10
E) 4.963

34. Calculate the pH of a solution prepared by dissolving 0.850 mol of NH_3 and 0.350 mol of NH_4Cl in water sufficient to yield 1.00 L of solution. The K_b of ammonia is 1.77×10^{-5}.

A) 5.137
B) 4.367
C) 9.633
D) 8.781
E) 8.863

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35. A 25.0 mL sample of 0.723 M $HClO_4$ is titrated with a 0.273 M KOH solution. The H_3O^+ concentration after the addition of 60.0 mL of KOH is _____ M.

A) 0.0181
B) 0.430
C) 0.0200
D) 0.273
E) none of the above

36. A 25.0 mL sample of an HCl solution is titrated with a 0.139 M NaOH solution. The equivalence point is reached with 25.3 mL of base. The concentration of HCl is _____ M.

A) 11.7
B) 0.00352
C) 0.141
D) 0.0352
E) 0.139

37. The pH of a solution prepared by mixing 45.0 mL of 0.183 M KOH and 25.0 mL of 0.145 M HCl is _____.

A) 1.314
B) 1.181
C) 0.00824
D) 12.819
E) 12.923

38. The pH of a solution prepared by mixing 55.0 mL of 0.183 M KOH and 30.0 mL of 0.145 M $HC_2H_3O_2$ is _____.

A) 9.97
B) 7.74
C) 1.172
D) 12.828
E) none of the above

39. What is the pH of an aqueous solution at 25.0 °C that contains 3.98×10^{-9} M hydronium ion?

A) 8.400
B) 5.600
C) 9.000
D) 3.980
E) 7.000

40. What is the pOH of an aqueous solution at 25.0 °C that contains 3.98×10^{-9} M hydronium ion?

A) 8.400
B) 5.600
C) 9.000
D) 3.980
E) 7.000

41. What is the pH of an aqueous solution at 25.0 °C that contains 3.98×10^{-9} M hydroxide ion?

A) 8.40
B) 5.60
C) 9.00
D) 3.98
E) 7.00

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42. Calculate the concentration (in M) of hydronium ions in a solution at 25.0°C with a pOH of 4.223.

A) 5.98×10^{-5}

B) 1.67×10^{-10}

C) 1.67×10^{4}

D) 5.99×10^{-19}

E) 1.00×10^{-7}

43. Calculate the concentration (in M) of hydroxide ions in a solution at 25.0°C with a pOH of 4.223.

A) 5.98×10^{-5}

B) 1.67×10^{-10}

C) 1.67×10^{4}

D) 5.99×10^{-19}

E) 1.00×10^{-7}

44. An aqueous solution contains 0.100 M NaOH at 25.0°C. The pH of the solution is _____.

A) 0.100
B) 1.00
C) 13.00
D) 7.00
E) -1.00

45. An aqueous solution contains 0.150 M HCl at 25.0°C. The pH of the solution is _____.

A) 0.150
B) 1.00
C) 13.00
D) 7.00
E) 0.82

46. The pH of a 0.25 M aqueous solution of hydrofluoric acid, HF, at 25.0°C is 2.03. What is the value of K_a for HF?

A) 2.0×10^{-9}

B) 1.1×10^{-9}

C) 6.0×10^{-5}

D) 3.5×10^{-4}

E) none of the above

47. The pH of a 0.60 M aqueous solution of formic acid, $HCHO_2$, at 25.0°C is 1.98. What is the value of K_a for formic acid?

A) 2.0×10^{-5}

B) 1.8×10^{-4}

C) 6.0×10^{-5}

D) 3.5×10^{-4}

E) none of the above

48. The K_a of acetic acid ($HC_2H_3O_2$) is 1.8×10^{-5}. What is the pH at 25.0°C of an aqueous solution that is 0.100 M in acetic acid?

A) +2.87
B) -2.87
C) -11.13
D) +11.13
E) +6.61

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49. The acid-dissociation constants of sulfurous acid (H_2SO_3) are $K_a1 = 1.7 \times 10^{-2}$ and $K_a2 = 6.4 \times 10^{-8}$ at 25.0°C. Calculate the pH of a 0.163 M aqueous solution of sulfurous acid.

A) 4.53
B) 1.28
C) 1.86
D) 6.21
E) 1.93

50. The acid-dissociation constants of phosphoric acid (H_2PO_3) are $K_a1 = 7.5 \times 10^{-3}$, $K_a2 = 6.2 \times 10^{-8}$, and $K_a3 = 4.2 \times 10^{-13}$ at 25.0°C. What is the pH of a 2.5 M aqueous solution of phosphoric acid?

A) 1.82
B) 0.40
C) 2.51
D) 0.86
E) 0.13

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PHYSICAL PROPERTIES

51. What is the physical state in which matter has no specific shape but does have a specific volume?
A) gas
B) solid
C) liquid
D) salts
E) ice

52. The law of constant composition applies to _____.
A) solutions
B) heterogeneous mixtures
C) compounds
D) homogeneous mixtures
E) solids

53. A combination of sand, salt, and water is an example of a _____.
A) homogeneous mixture
B) heterogeneous mixture
C) compound
D) pure substance
E) solid

54. A small amount of salt dissolved in water is an example of a _____.
A) homogeneous mixture
B) heterogeneous mixture
C) compound
D) pure substance
E) solid

55. Which one of the following is a pure substance?
A) concrete
B) wood
C) salt water
D) elemental copper
E) milk

56. Which one of the following is often easily separated into its components by simple techniques such as filtering or decanting?
A) heterogeneous mixture
B) compounds
C) homogeneous mixture
D) elements
E) solutions

57. Which states of matter are significantly compressible?
A) gases only
B) liquids only
C) solids only
D) liquids and gases
E) solids and liquids

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58. For which of the following can the composition vary?
A) pure substance
B) element
C) both homogeneous and heterogeneous mixtures
D) homogeneous mixture
E) heterogeneous mixture

59. If matter is uniform throughout and cannot be separated into other substances by physical means, it is _____.
A) a compound
B) either an element or a compound
C) a homogeneous mixture
D) a heterogeneous mixture
E) an element

60. An element cannot _____.
A) be part of a heterogeneous mixture
B) be part of a homogeneous mixture
C) be separated into other substances by chemical means
D) interact with other elements to form compounds
E) be a pure substance

61. Homogeneous mixtures are also known as _____.
A) solids
B) compounds
C) elements
D) substances
E) solutions

62. In the following list, only _____ is not an example of a chemical reaction.
A) dissolution of a penny in nitric acid
B) the condensation of water vapor
C) a burning candle
D) the formation of polyethylene from ethylene
E) the rusting of iron

63. Gases and liquids share the property of _____.
A) compressibility
B) definite volume
C) incompressibility
D) indefinite shape
E) definite shape

64. Of the following, only _____ is a chemical reaction.
A) melting of lead
B) dissolving sugar in water
C) tarnishing of silver
D) crushing of stone
E) dropping a penny into a glass of water

65. Which one of the following is not an intensive property?
A) density
B) temperature
C) melting point
D) mass
E) boiling point

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66. Which one of the following is an intensive property?
A) mass
B) temperature
C) heat content
D) volume
E) amount

67. Of the following, only _____ is an extensive property.
A) density
B) mass
C) boiling point
D) freezing point
E) temperature

68. Which of the following are chemical processes?
1. rusting of a nail
2. freezing of water
3. decomposition of water into hydrogen and oxygen gases
4. compression of oxygen gas

A) 2, 3, 4
B) 1, 3, 4
C) 1, 3
D) 1, 2
E) 1, 4

69. In the following list, only _____ is not an example of a chemical reaction.
A) burning a plastic water bottle
B) the production of hydrogen gas from water
C) the tarnishing of a copper penny
D) chopping a log into sawdust
E) charging a cellular phone

70. Which of the following liquids has the greatest density?
A) 13 cm^3 with a mass of 23 g
B) 3.5 cm^3 with a mass of 10 g
C) 0.022 cm^3 with a mass of 0.10 g
D) 54 cm^3 with a mass of 45 g
E) 210 cm^3 with a mass of 12 g

71. You have to calculate the mass of a 30.0 mL liquid sample with density of 1.52 g/mL, but you have forgotten the formula. Which way of reasoning would help you in finding the correct mass?
A) If 1 mL of a liquid has the mass of 1.52 g, then 30.0 mL has the mass of _____ g.
B) If 1.52 mL of a liquid has the mass of 1 g, then 30.0 mL has the mass of _____ g.

72. Osmium has a density of 22.6 g/cm^3. What volume (in cm^3) would be occupied by a 21.8 g sample of osmium?
A) 0.965
B) 1.04
C) 493
D) 2.03×10^{-3}
E) 2.03×10^{3}

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73. Gold has a density of 0.01932 kg/cm^3. What volume (in cm^3) would be occupied by a 33.3 g sample of gold?
A) 0.663
B) 5.80 x 10^{-4}
C) 5.80
D) 0.581
E) 1.72

74. Iron has a density of 7.9 g/cm^3. What is the mass of a cube of iron with the length of one side equal to 55.0 mm?
A) 2.1 x 10^4 g
B) 4.3 x 10^2 g
C) 1.3 x 10^3 g
D) 1.4 g
E) 2.3 x 10^{-2} g

75. A cube of an unknown metal measures 1.61 mm on one side. The mass of the cube is 36 mg. Which of the following is most likely the unknown metal?

Metal	Density (g/ cm^3)
rhodium	12.4
copper	8.96
niobium	8.57
vanadium	6.11
zirconium	6.51

A) copper
B) rhodium
C) niobium
D) vanadium
E) zirconium

76. A wooden object has a mass of 10.782 g and occupies a volume of 13.72 mL. What is the density of the object determined to an appropriate number of significant figures?
A) 8×10^{-1} g/mL
B) 7.9×10^{-1} g/mL
C) 7.86×10^{-1} g/mL
D) 7.859×10^{-1} g/mL
E) 7.8586×10^{-1} g/mL

77. If matter is uniform throughout and cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is called a (an) _____.
A) heterogeneous mixture
B) element
C) homogeneous mixture
D) compound
E) mixture of elements

78. A separation process that depends on differing abilities of substances to form gases is called _____.
A) filtration
B) solvation
C) distillation
D) chromatography
E) All of the above are correct.

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79. The density of a gold nugget is 19.3 g/cm^3. If the volume of the gold nugget is 0.00369 L, the mass of the nugget is _____.

A) 71.2
B) 0.191
C) 19.3
D) 5.23
E) none of the above

80. The length of the side of a cube having a density of 12.6 g/ml and a mass of 7.65 g is _____ cm.

A) 3.20
B) 0.847
C) 1.02
D) 0.584
E) 1.32

81. A certain liquid has a density of 2.67 g/cm^3. 30.5 mL of this liquid would have a mass of _____ Kg.

A) 81.4
B) 11.4
C) 0.0875
D) 0.0814
E) 0.0114

82. Osmium has a density of 22.6 g/cm^3. The mass of a block of osmium that measures 1.01 cm × 0.233 cm × 0.648 cm is _____ g.

A) 6.75×10^{-3}
B) 3.45
C) 148
D) 6.75×10^{3}
E) 34.5

83. 3.337 g/cm^3 = _____ kg/m^3

A) 3.337×10^{-9}
B) 3.337×10^{-5}
C) 3337
D) 0.3337
E) 333.7

84. One side of a cube measures 1.55 m. The volume of this cube is _____cm^3.

A) 2.40×10^{4}
B) 3.72×10^{6}
C) 2.40
D) 3.72
E) 155

85. A 4.369 g sample of metal is placed in a flask. Water is added to the flask and the total volume in the flask is read to be 126.4 ml. The mass of the water, flask, and metal is 268.5 g. If the mass of the flask is 139.3 g and the density of water is 1.000 g/ml, the density of the solid is _____ g/cm3.

A) 0.366
B) 1.56
C) 0.641
D) 2.73
E) 3.21

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86. What is the volume (in cm^3) of a 63.4 g piece of metal with a density of 12.86 g/cm^3?
A) 4.93
B) 19.5
C) 0.425
D) 6.65
E) none of the above

87. The density of silver is 10.5 g/cm^3. A piece of silver with a mass of 125 g would occupy a volume of _____ cm^3.
A) 0.171
B) 644
C) 10.5
D) 0.00155
E) 11.9

88. Which one of the following statements is correct?
a) Pure substances may be separated by filtration or distillation into at least two components.
b) A heterogeneous mixture is also known as a solution.
c) A heterogeneous mixture is composed of two or more substances in the same phase.
d) The composition is uniform throughout a homogeneous mixture.
e) The combination of two or more liquids always results in a homogeneous mixture.

89. Which one of the following is most likely to be a homogeneous mixture?
a) blood
b) ground beef
c) the air trapped inside an inflated balloon
d) chocolate chip cookies
e) mortar (a mixture of calcium carbonate and sand)

90. Which one of the following statements is not a comparison of physical properties?
a) Potassium reacts with water more quickly than calcium reacts with water.
b) The electrical conductivity of aluminum is greater than copper.
c) The density of ice is less than liquid water.
d) Ethylene glycol (antifreeze) is more viscous than water.
e) Gold is more malleable than titanium.

91. All of the following are physical properties EXCEPT
a) the viscosity of motor oil.
b) the rusting of iron.
c) the boiling point of water.
d) the melting point of gold.
e) the conductivity of copper wire.

92. Which one of the following statements is not a comparison of physical properties?
a) Mercury and gallium are both liquids at 50 ºC.
b) Carbon dioxide is more soluble in water than oxygen.
c) Copper and silver are malleable metals.
d) Oxygen and nitrogen are gases at 25 ºC.
e) Water may be split by electrolysis into hydrogen and oxygen.

93. An intensive property of a substance is
a) independent of the amount present.
b) dependent on its volume, but not its mass.
c) not affected by its temperature.
d) dependent only on its temperature.
e) dependent only on its mass and volume.

DO NOT MARK ON THIS QUESTION BOOKLET

94. Which of the following are extensive properties: mass, volume, and/or density?
a) mass only
b) volume only
c) density only
d) mass and volume
e) volume and density

95. All of the following are examples of intensive properties EXCEPT
a) melting point.
b) color.
c) mass.
d) density.
e) boiling point.

96. The density of ice at 0 ºC is 0.917 g/mL. What is the volume of 225 g of ice?
a) 0.00407 mL b) 18.7 mL c) 206 mL d) 226 mL e) 245 mL

97. The density of liquid mercury is 13.5 g/cm^3. What mass of mercury will fill a 12.0 ounce soda can? (1.00 oz = 29.6 mL, 1.00 mL = 1.00 cm^3)
a) 0.0380 g b) 26.3 g c) 162 g d) 369 g e) 4.80 x 10^3 g

98. You can identify a metal by carefully determining its density. A 33.39 g sample of an unknown metal is 1.50 cm long, 2.50 cm wide, and 1.00 cm thick. What is a possible identity of the element?
a) nickel, 8.90 g/cm^3
b) aluminum, 2.70 g/cm^3
c) silver, 10.5 g/cm^3
d) iron, 7.87 g/cm^3
e) chromium, 7.20 g/cm^3

99. A cube of zirconium has a mass of 343 g. If each side of the cube has dimensions of 3.75 cm, what is the density of zirconium?
a) 0.0410 g/cm^3 b) 0.154 g/cm^3 c) 6.50 g/cm^3 d) 24.4 g/cm^3 e) 18.1 g/cm^3

100. You can identify a metal by carefully determining its density. A 20.05 g cylinder of an unknown metal is 2.00 cm long and has a diameter of 0.755 cm. What is a possible identity of the element? (Volume = $\pi r^2 h$)
a) silver, 10.5 g/cm^3
b) iridium, 22.4 g/cm^3
c) gold, 19.3 g/cm^3
d) lead, 11.4 g/cm^3
e) nickel, 8.90 g/cm^3