1. (1.00 pts) Consider Boyle's law. Which of the following are constant quantities?

(Mark **ALL** correct answers)

- ☐ A) P
- ☐ B) V
- ☑ C) n
- ☑ D) T

2. (1.00 pts) Consider Avogadro's law. Which of the following are variable quantities?

(Mark **ALL** correct answers)

- ☐ A) P
- ☑ B) V
- ☑ C) n
- ☐ D) T

3. (1.00 pts) What is the ideal gas law?

Expected Answer: PV=nRT

4. (1.00 pts) What does the acronym "STP" stand for?

Expected Answer: standard temperature and pressure

5. (3.00 pts) Archimedes' Principle is that anything submerged in a(n) _____ is acted upon by a(n) _____ force, the value of which is equal to the _____ displaced.

| fluid | buoyant | weight |

6. (2.00 pts) Density is _____ divided by _____.

| mass | volume |

7. (1.00 pts)   A _____ is used to measure atmospheric pressure.

| barometer |

8. (2.00 pts)   Pressure is _____ per unit _____.

| force | | area |

9. (2.00 pts)

Given all other relevant variables are held constant, Charles' law states that temperature and _____ are proportional while Gay-Lussac's states that temperature and _____ are proportional.

| volume | | pressure |

10. (1.00 pts)   Which symbol represents the ideal gas constant?

- ○ A) k
- ● B) R
- ○ C) h
- ○ D) g

11. (1.00 pts)   What is the definition of "weight"?

Expected Answer: the gravitational force on an object

12. (5.00 pts)   Why do balloons float if you inflate them with helium, but they do not float if you inflate them with air?

Expected Answer: Helium is less dense than air, so the balloon is buoyant. Air inside the balloon is not less dense than the outside air, so the balloon sinks.

13. (5.00 pts)   A cylindrical jar has 65 pieces of candy in it. The jar has a diameter of 0.20 m and a height of 0.30 m. What is the number density of the candy in the jar?

Expected Answer: Calculate the volume of the jar. The diameter is 0.20 m, therefore the radius is 0.20 m / 2 = 0.10 m. V = 3.14159 * (0.10 m)^2 * (0.30 m) = 0.00942477 m^3 Divide the number of pieces of candy (65) by the volume. The number density is 65 pieces of candy / 0.00942477 m^3 = 6897 pieces of candy per cubic meter. That's a lot of candy!

14. (1.00 pts)   The multiplier 10^{-12} corresponds to which prefix?

○ A) nano-

○ B) micro-

● C) pico-

○ D) tera-

15. (1.00 pts)   The multiplier 10^{15} corresponds to which prefix?

○ A) femto-

○ B) terra-

● C) peta-

○ D) pico-

16. (1.00 pts)   What is the definition of temperature?

Expected Answer: Temperature is a measure of the kinetic energy of molecules

17. (5.00 pts)   Is ice more or less dense than liquid water? Explain.

Expected Answer: Ice is less dense. Ice floats, therefore it must be less dense than water.

18. (1.00 pts)   What is a Pascal a unit of?

○ A) temperature

○ B) volume

● C) pressure

○ D) density

19. (1.00 pts)   What is Kelvin a unit of?

○ A) pressure

○ B) volume

● C) temperature

○ D) density

20. (1.00 pts)   What are the units of heat?

○ A) Kelvin

○ B) Pascals

⦿ C) Joules

○ D) Newtons

21. (1.00 pts)   There is 15.24 g of clay in a soil sample. This sample is in 1000 mL of water. What is the density?

⦿ A) 15.24 g/L

○ B) 1524 g/mL

○ C) 3048 g/L

○ D) 2.532 g/mL

22. (1.00 pts)   Which of the following is equivalent to 15 degrees Fahrenheit?

○ A) 98.23 Kelvin

○ B) 204 degrees Celsius

○ C) -9.444 degrees Celsius

⦿ D) 263.7 Kelvin

23. (1.00 pts)   What is the melting point of water?

○ A) 33 degrees Fahrenheit

⦿ B) 0 degrees Celsius

○ C) 273.7 Kelvin

○ D) 100 degrees Celsius

24. (1.00 pts)   Absolute zero is defined as zero degrees Fahrenheit.

○ True   ⦿ False

25. (1.00 pts)   The freezing point of water is 32 degrees Celsius.

○ True   ⦿ False

26. (1.00 pts)   Silver has a density of 10.49 g/cm^3 while gold has a density of 19.30 g/cm^3. Assuming the volume is the same, gold would be weigh more than silver.

⦿ True   ○ False

27. (2.00 pts)
Oil and water do not mix. Oil will be a layer on top of the water, with a distinct boundary between the oil and the water. What can you infer about the density of the oil?

Expected Answer: The oil is less dense than water, because it floats on the water.

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28. (5.00 pts) Freshwater is less dense than saltwater. Why do you think this is?

Expected Answer: Saltwater has salt, while freshwater does not. Therefore, saltwater has more mass, resulting in it being more dense.

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29. (5.00 pts) What is the difference between molality and molarity?

Expected Answer: Molality is the moles of solute divided by the mass while molarity is the moles of solute divided by the volume.

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30. (5.00 pts) What is the difference between mass and weight?

Expected Answer: mass describes the amount of matter, while weight describes the gravitational force on that matter

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31. (5.00 pts) What is an ideal gas?

Expected Answer: A gas with minimal (ideally, no) interparticle interactions.

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32. (10.00 pts) You are performing an experiment and have 20.0 grams of table salt, NaCl, which has a molecular weight of 58.44 g/mol. How many atoms of NaCl do you have?

Expected Answer: 20.0 g NaCl x (1 mol NaCl / 58.44 g NaCl) x (6.022 x 10^23 atoms / 1 mol) = 2.07 x 10^23 atoms NaCl

33. (15.00 pts)
If you were designing an aluminum boat meant to float in water while carrying pennies, how would you design it? What would you need to take into consideration? Be specific.

Expected Answer:

34. (1.00 pts)   The density of lead is 11.3 g/cm^3, would this float or sink in seawater?

- ○ A) float
- ● B) sink
- ○ C) cannot be determined

35. (1.00 pts)   The density of pine wood is 0.373 g/cm^3, would this float or sink in seawater?

- ● A) float
- ○ B) sink
- ○ C) cannot be determined

36. (1.00 pts)   The density of cork is 0.240 g/cm^3, would this float or sink in seawater?

- ● A) float
- ○ B) sink
- ○ C) cannot be determined

37. (1.00 pts)   The density of diamond is 3.50 g/cm^3, would this float or sink in seawater?

- ○ A) float
- ● B) sink
- ○ C) cannot be determined

38. (1.00 pts)   The density of titanium is 4.540 g/cm^3, would this float or sink in seawater?

- ○ A) float
- ● B) sink
- ○ C) cannot be determined

39. (1.00 pts)   If the mass of a sphere is 5.0 g and the volume is 30 cm^3, what is the density?

- ○ A) 6.0 g/mL
- ● B) 0.17 g/mL

○ C) 17 g/mL

○ D) 60 g/mL

40. (1.00 pts) A cube has 4.0 kg of mass. The length of each side is 2.0 m. What is the cube's density?

○ A) 2.0 kg/m^3

● B) 0.50 kg/m^3

○ C) 1.0 kg/m^3

○ D) 8.0 kg/m^3

41. (1.00 pts) Oak wood has a density of 0.710 g/cm^3. If you have a block of oak wood that is 10 cm x 15 cm x 20 cm, how much oak do you have in grams?

○ A) 4225 grams

○ B) 6355 grams

● C) 2130 grams

○ D) 2095 grams

42. (1.00 pts)
Titanium has a density of 4.540 g/cm^3. If you have a small titanium cube with sides equal to 3.0 cm, how many moles of titanium do you have? The molecular weight of titanium is 47.87 g/mol.

○ A) 0.28 mol

● B) 2.6 mol

○ C) 1.8 mol

○ D) 4.3 mol

43. (1.00 pts)
Copper has a density of 8.94 g/cm^3 while iron has a density of 7.87 g/cm^3. If you have two equal size cubes, one of copper and one of iron, will you have more moles of copper or more moles of iron? The molecular weight for copper is 63.55 g/mol and the molecular weight for iron is 55.84 g/mol. Use three decimal places to make your comparison.

○ A) You would have more moles of copper.

○ B) You would have more moles of iron.

● C) You would have equal moles of copper and iron.

○ D) Cannot be determined from the information provided.

44. (1.00 pts) Will a more dense fluid (such as saltwater) be more or less buoyant than a less dense fluid (such as freshwater)?

● A) more buoyant

○ B) less buoyant

○ C) cannot be determined

45. (1.00 pts) What is a graduated cylinder used to measure?

○ A) density

○ B) mass

◉ C) volume

○ D) pressure

46. (1.00 pts) What is a balance used to measure?

○ A) density

◉ B) mass

○ C) volume

○ D) pressure

47. (1.00 pts) Assuming a constant volume and amount of gas, as the pressure increases, the volume _____.

increases

48. (1.00 pts) Assuming a constant pressure and amount of gas, as the volume increases, the temperature _____.

increases

49. (2.00 pts)
Stradivarius violins were crafted during the 1600-1700s and are well known for their superior sound quality. This is theorized to be due to the geographic location in which the wood was sourced. During the Little Ice Age, growing conditions were very harsh so tree rings grew extremely close together. How do you think the density of trees from regions most affected by the Little Ice Age would compare to trees grown in other regions with less harsh conditions?

Expected Answer: The trees that grew in harsh conditions are very dense because their tree rings are very close together. In less harsh conditions, the tree rings would be further apart, resulting in less dense wood.

50. (2.00 pts)
Thunderstorms often form when two air masses--one warm and moist, the other cool and dry--collide. This is why the states bordering the Gulf of Mexico, such as Louisiana, Mississippi, Alabama, and Florida, sometimes experience severe weather in the winter. Cool, dry air plunges down from Canada and meets extremely warm, moist air from the Gulf of Mexico. Based on what you know about density and temperature, what do you think would happen when a cold air mass is on top of a warm air mass?

Expected Answer: The warm air underneath the cold air mass would rise up, while the cold air above the warm air mass would sink. This creates circulation that contributes to thunderstorm development.