Score_____/72 pts

Team Number: _____

Student Names: _____

Team Name: _____

Density Lab Exam

Note: Please show **ALL** work. Units matter towards your score.

1 bar = 100,000 Pa which is approximately atmospheric pressure.

Which 5 are correct density units (1 pt each)

1. _____
2. _____
3. _____
4. _____
5. _____

a) Kg   b) moles/m^3
c) houses/km^2 d) m/sec^2
e) Kg-m /sec   f) kg/m
g) g/m^3 h) kg/m^3
i) Degrees C   j) people^3/sec

1. PV = nRT is the Ideal Gas Law. Please define all 5 terms and give exemplary units for each term such that the equation will balance. (5 pts)

2. The following picture has three liquids with different densities. Select which option best describes the liquids relative densities. (2 pts)
    a. Blue>White>Red
    b. Red>White>Blue
    c. All equal
    d. While>Blue>Red

3. The Ideal Molar Volume is the volume of a mole of gas at STP (standard temperature and pressure). What is the value for this volume. (2 pts)

4. Copper is more dense than wood. Which has a larger volume, a 10 g sample of wood or a 10 g sample of copper? (2 pts)
   a. They are the same
   b. Not enough information to solve
   c. Copper
   d. Wood

5. Two cylinders are connected. The first has an unknown volume but is in perfect vacuum. The second is filled with argon, has a volume of 300 ml, and a pressure of 2 bar. If a valve is opened between the two cylinders, the final pressure is 1.4 bar. What is the volume of cylinder 1? (you may assume the temperature is constant) (3 pts)

6. Which is larger? (1 pt each)
   i. A
   ii. B
   iii.   The same
   iv.   Not enough information

I.   A. 1%   B. 10,000 ppm   _____
II.   A. 100 ppm   B. 100 ppb   _____
III.   A. 1 microliter   B. 1 liter   _____

7. In a car engine, gas (a fuel/air mixture) is injected into the cylinder, the valves close and the piston rises, decreasing the volume by a factor of 8. If the initial pressure is 1 bar, what is the final pressure? Please assume ideal gas behavior and no change in temperature. (3 pts)

> i. 8 bar
> ii. 4 bar
> iii. .125 bar
> iv. Cannot be determined

8. When the spark plug sparks, the temperature will go from 50 C to 1050 C, If the piston does not move (and the engine block doesn't blow up, which it almost certainly would) how much would the pressure rise? (3 pts)

> i. x 10
> ii. x1050
> iii. x 21
> iv. x4

9. Whose work is not included in the Ideal Gas Law (2 pts)
   a. Boyle
   b. Archimedes
   c. Guy-Lussac
   d. Charles

10. What is Avogadro's Number (2 pts)
    a. 6
    b. 6.02
    c. 8.314×10^{14}
    d. 6.02×10^{23}

True / False (1 pt each)

11. Gases become denser as they cool. _____
12. Ice is denser than water _____
13. The Ideal Gas law is true for all gases at all conditions _____
14. All metal objects will sink in water _____
15. If two objects have the same mass but different volumes, the larger volume will have greater density

_____

16. Buoyancy is an upward force a fluid exerts that oppose the effect of gravity on an immersed object

_____

17. Archimedes determined the properties of density sitting in a bath tub _____

18. Which is not a representation of the Ideal gas law? (2 pts)
    a. PV = nRT
    b. T = VP/nR
    c. R = nT/PV
    d. P = RTn/V

19. A liter of liquid nitrogen weighs 807 g. It has a molecular weight of 28. If I heat the gas to 293 K at atmospheric pressure, what is the final gas volume in liters? (3 pts)

Experiment 1
Explain the video (6 pts)

Experiment 2
What is the volume and density of the sample (6 pts)

Experiment 3

What is the volume and density of the sample? (6 pts)

Experiment 4

What is the number density of (2 pts each)

1.   Blue states
2.   Yellow
3.   Green

Experiment 5

What is the volume density of pink erasers? (3 pts)

What is the number density of pink erasers? (3 pts)