Physics
Final Exam Practice Part II

Name: _____

Formulas:

1psi = 6,895pa
P=F/A
F=PA
work=Fd
KE ≈ work

KE = ½ mv^2
v=d/t
1cm = 0.01m
1m = 100cm
1m/s = 2.24mph

1N = 0.224 pounds
[To convert N to pounds, multiply Newtons by 0.224]

Questions:

1. The metric units for air pressure are pascals (pa). If the air pressure is 100,000 pa, what exactly does that mean?
2. Right now, there is air pressure around us. Explain how that air pressure was created.
3. What is the approximate strength of the air pressure in this room, in psi?
4. What is the approximate strength of the air pressure in this room, in pa?
5. Suppose there is a giant, square suction cup stuck to a tile floor. The edges of the square suction cup are 2m long. What total force of air pressure (in Newtons) is pushing against the suction cup's surface?
6. What total force of air pressure (in pounds) is pushing against the suction cup's surface?
7. If the force of air pressure is so strong, why doesn't it squish us? Give two reasons.
8. Where is there stronger air pressure, in low valleys or on high mountaintops? Explain why.
9. If you ride up an elevator to the top of a very tall building, your ears will hurt. Explain what is happening to your ears, and why.
10. A swimmer wants to swim to the bottom of a 30 foot deep lake. Her ears hurt too much to do this. What can she do in order to decrease her ear pain (without using ear plugs or any other cover or device)? Explain why this works.
11. Any floating object floats because of the force of buoyancy. Helium balloons float in air. Cork floats in water. Explain where this buoyant force comes from. Use words and a diagram.

Problems:

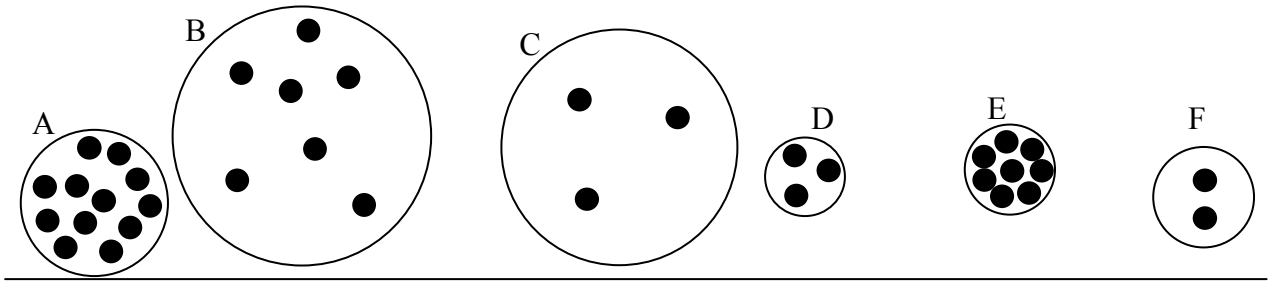
12. A car is traveling at a velocity of 14 m/s. What is its velocity in miles per hour?
13. A potato chunk is shot from a potato gun. The area of the potato that is pushed by pressurized air is $0.0005m^2$. If the gauge pressure of the tank is 300,000pa, what force does the tank pressure apply to the potato?
14. The length of a potato gun barrel is 83 centimeters. What is the barrel length, in meters?
15. If the air pressure in the gun applies a force of 500N to the potato, How much work is done on the potato as it is pushed down the cannon's barrel?
16. *Assuming that there is no friction in the barrel*, how much kinetic energy will the potato in the previous question have as it leaves the barrel?
17. Suppose 300j of work is done on a 0.02kg potato chunk as it is pushed down a potato gun barrel. How fast will this chunk move as it leaves the barrel *(assuming no friction)*? Provide your answer in m/s.
18. A potato chunk has a muzzle velocity of 85m/s. What is that velocity in miles per hour?

19-20. As soon as the potato leaves the barrel, it passes through a pair of photo gates. The gates are 12 cm apart, and the potato passes between them in 0.0034s.

19. What is the distance between the gates, in meters?
20. What is the actual velocity of the potato in m/s?

The objects below are mostly empty space. The circle is the edge of each object. The dots inside represent all of each object's mass. The empty space inside the objects has no air or mass of any kind.

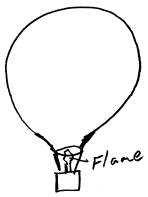
21. Which object has the most weight? ____
22. Which object has the least weight? ____
23. Which object has the most volume? ____
24. Which object has the least volume? ____
25. Which object is most dense? ____
26. Which object is least dense? ____
27. Which object has the most mass? ____
28. Which object has the least mass? ____



29. From a physics standpoint, there are two fundamentally different ways for your weight to change. What are they?
30. When you compress something, does that make it more dense or less dense? Explain why.
31. Briefly describe two **different** ways to increase the density of an object.
32. Will those changes (from the previous question) make the object more likely or less likely to float?
33. Briefly describe two **different** ways to decrease the density of an object.

34. Objects that are less dense float upward. What is the name of the force that pushes less dense objects upward?
35. Explain how that force (from the previous question) is created.

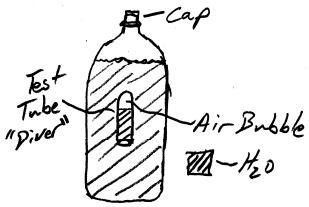
A hot air balloon is hovering over Burlington. Suddenly, the captain of the balloon ignites a large flame. This heats up the balloon, and the balloon begins to rise. Soon after the flame is ignited…



36. What happens to the overall volume of the balloon?
37. What happens to the overall mass of the balloon?
38. Why?
39. What happens to the overall density of the balloon?
40. Why?

A sealed bottle is filled with water. Floating upside-down in the water is a test tube. The test tube (called a "cartesian diver") has a bubble of air inside it. What happens when you squeeze the container? Complete parts a-g, below. When you squeeze…

41. Does the diver go up, down, or neither?
42. What happens to the overall volume of the diver?
43. Why?
44. What happens to the overall mass of the diver?
45. Why?
46. What happens to the overall density of the diver?
47. Why?



A hot air balloon was flown. A rope was tied to the balloon, and the balloon was allowed to lift as much rope as it could. Eventually, the balloon lifted 128cm of rope and hovered in that position.

- 1 second of fill time (vacuum cleaner) = $0.02m^3$ volume of air
- 1cm of rope = 0.00018kg
- 1g = 0.001kg

48. If the balloon took 32 seconds to fill, what was its volume?
49. If the balloon's empty mass (no air, no rope) was 62g, what is that mass, in kg?
50. If 128cm of rope was hanging from the balloon, what was the total mass of hanging rope?
51. What was the total mass of the balloon (including the rope) just before the candles were blown out?
52. What was the mass of hot air inside the balloon just before the candles were blown out?
53. What was the density of the hot air inside the balloon, just before the candles were blown out?