EPS 200 (Stapleton)
Unit 1 Test Review

Name: Answers

The upcoming test will include questions and concepts similar to the items in this review. There will be no new concepts on the test that do not appear in some form on this review, but simply memorizing the answers to these questions without understanding the underlying concepts will not adequately prepare you for the test. The test will be shorter than this review.

For each of the following units...

1. What is the density of fresh water? Give your answer in two different units.

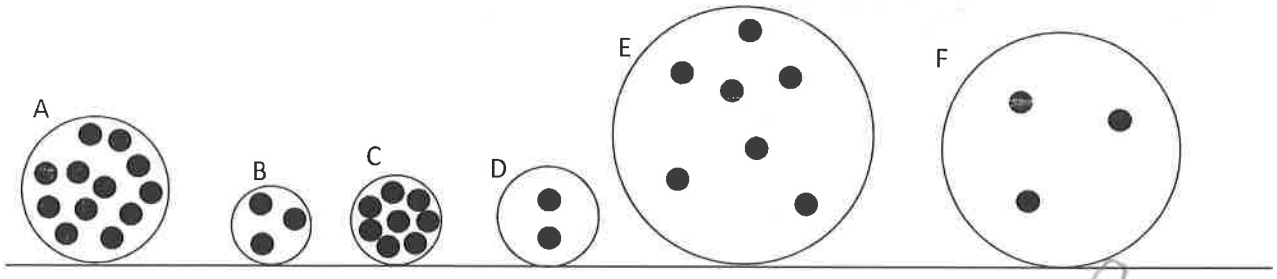
ρ_{water} = 1g/mL ρ_{water} = 1000 kg/m^3 = 1kg/L

2. Explain the relationship between mass and weight.

Weight is the force of gravity that pulls an object and a planet together. The more mass the object and planet have, the more the object weighs.

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.

3. Which object has the most weight? A
4. Which object has the least weight D?
5. Which object has the most volume? E
6. Which object has the least volume? B
7. Which object is most dense? C
8. Which object is least dense? F
9. Which object has the most mass? A
10. Which object has the least mass? D



When a blob in a lava lamp heats up, it begins to rise. When this happens, what happens to its...

11. mass = 12. volume + 13. density − 14. weight =

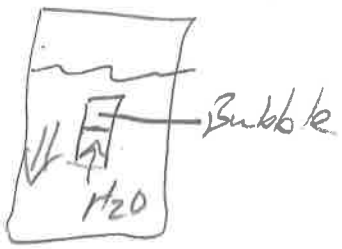
You drill one very large hole in a piece of wood. When you do this, what happens to the wood's...

15. mass − 16. volume − 17. density = *

L x W x H

A 2-liter bottle is full of water, and it also contains a "Cartesian diver." The "diver" is a test tube with its open end pointing downward. An air bubble is trapped in the diver. At first, the diver is floating at the top of the bottle. As the bottle is squeezed, the test tube begins to sink to the bottom. *As the bottle is being squeezed, what is happening to the test tube's...*

18. mass + 19. volume = 20. density + 21. weight +

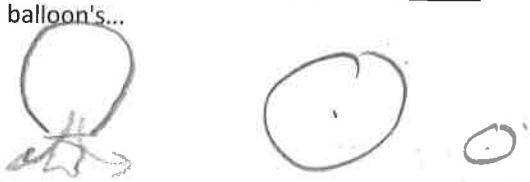


Someone exercises and gets much stronger. The person gets smaller, but his/her weight does not change. What has happened to the person's...

22. mass = 23. volume − 24. density +

Someone lights a large flame in a hot air balloon, and the balloon begins rising higher in to the sky. The size of the balloon does not change. While the flame is heating the balloon, what happens to the balloon's...

25. mass − 26. volume = 27. density − 28. weight −



You take a piece of paper to the moon. What happens to the paper's...

29. mass = 30. volume = 31. density = 32. weight −

A human weighs 140 pounds on Earth. This same human is standing on the surface of tiny Planet X. Planet X has a mass of 1×10^{12} kg, a radius of 1,000m, and a volume of $4.2\times10^{9}m^3$.

33. What is the density of planet X?

$$\rho = \frac{m}{V} = \frac{1\times10^{12}\,kg}{4.2\times10^{9}\,m^3} = 238\,kg/m^3$$

34. Is planet X more or less dense than water?

Less. $238\,kg/m^3 < 1{,}000\,kg/m^3$

35. What is the human's mass, in kg?

$$\left(\frac{140\,lbs}{1}\right)\left(\frac{1\,kg}{2.2\,lbs}\right) = 63.6\,kg$$

36. What is the weight of the human on planet X, in Newtons?

$$weight = F_{gravity} = \frac{6.67\times10^{-11}\,N\,m^2/kg^2\,(63.6\,kg)(1\times10^{12}\,kg)}{(1000\,m)^2} = 0.00424\,N$$

37. What is the weight of the human on planet X, in pounds?

$$\left(\frac{0.00424\,N}{1}\right)\left(\frac{1\,lb}{0.224\,N}\right) = 0.0189\,lbs$$

38. What would happen to the weight of the human on the surface of planet X if ***her*** **mass** were doubled?

$weight = \frac{G m_1 m_2}{d^2}$ — if this number is doubled, weight is doubled.

39. What would happen to the weight of the human on the surface of planet X if the ***planet's*** **mass** were doubled (without changing the planet's volume)?

If this # is doubled, weight is doubled.

40. What would happen to the weight of the human on the surface of planet X if the ***planet's*** **radius** were doubled (without changing the planet's mass)?

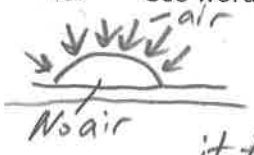
If distance is doubled, d^2 becomes $(2d)^2$, which equals $4d^2$. So, if distance is doubled, weight is divided by 4.

41. What causes atmospheric air pressure?

The weight of the air piled on top of us.

42. Describe how and why air pressure causes your ears to hurt when you rapidly travel to a higher elevation.

When you ascend, air pressure outside of your head decreases. The pressure inside your ear is stronger than outside pressure, so your ear drum stretches outward



43. Use words and a diagram to explain how suction cups work.

There is no air between a suction cup and the surface it sticks to. Outside air pressure pushes it toward the surface. No pressure pushes it out.

44. The average value of air pressure at sea level is 14.7 psi.

45. What do the letters "psi" stand for?

Pounds per square inch or $\frac{\text{pounds}}{\text{in}^2}$

46. Calculate the force of air pressure that is pushing against one side of a 5" x 7" photograph (at sea level).

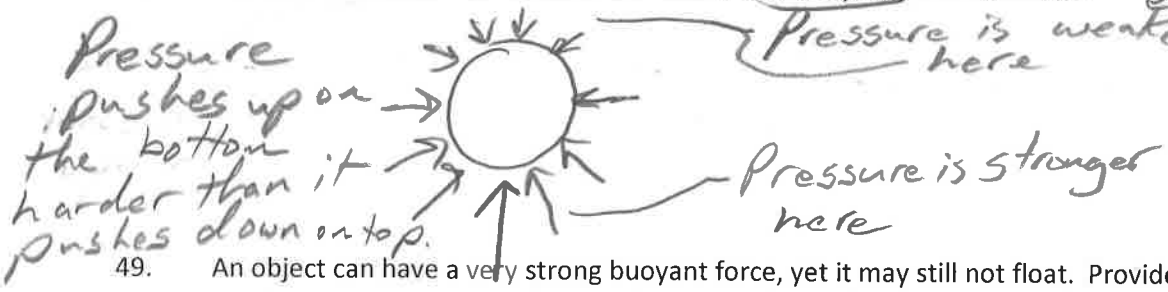
$5'' \times 7'' = 35 \text{ in}^2$ $\quad 35 \text{ in}^2 \left(\frac{14.7 \text{ pounds}}{\text{in}^2}\right) = 514.5 \text{ lbs}$

47. Give two reasons to explain why we are not smashed flat by the cumulative force of air pressure.

- We have pressure inside us, pushing out

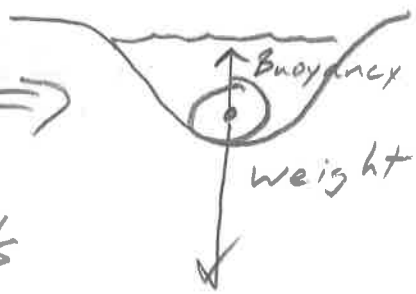
- The force of pressure is spread evenly over our bodies, and it pushes from every direction

48. Use a labeled diagram to show how the force of buoyancy lifts a bubble.



49. An object can have a very strong buoyant force, yet it may still not float. Provide a real life example of this happening. Then explain how it happens – why the object has a strong buoyant force, and why it sinks despite that force.

A boulder has a large buoyant force because it displaces a lot of water, but it is heavier than that water, so it still sinks.



50. State Archimedes' principle.

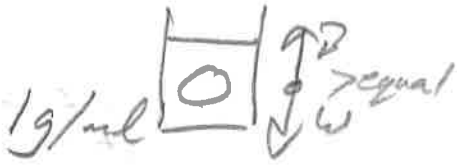
The force of buoyancy equals the weight of fluid displaced.

51. You drop an object in a graduated cylinder full of water. When you do this, the object floats, and the water level rises by 20ml.
What do you know about the object's...

a. Mass 20g b. Volume >20ml c. Density <1g/ml

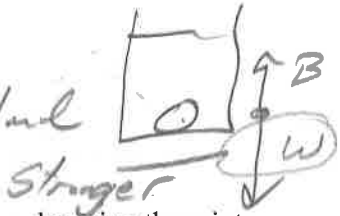
52. You drop another object in a graduated cylinder full of water. When you do this, the object neither sinks nor floats. It stays suspended between the water's surface and the bottom of the cylinder. The water level rises by 20ml.
What do you know about the object's...

a. Mass 20g b. Volume 20ml c. Density 1g/ml

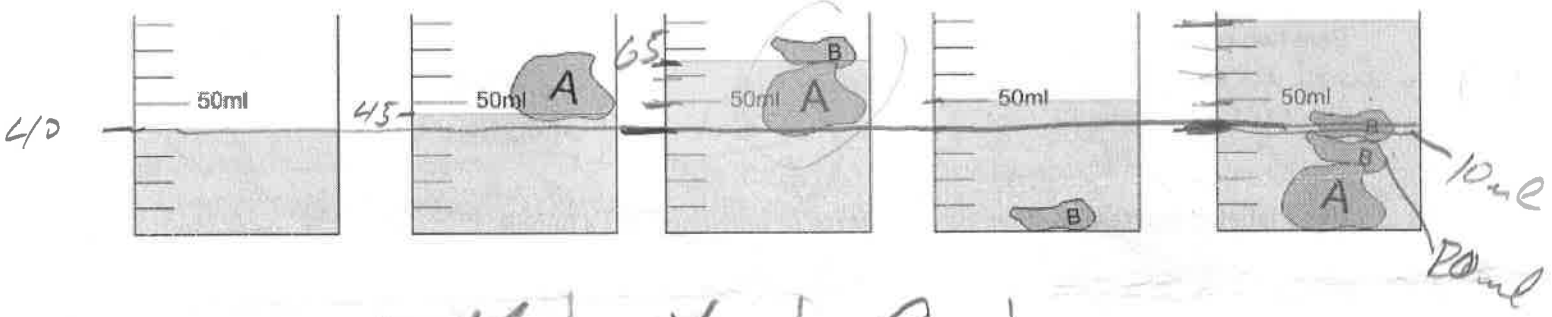


53. You drop a third object in a graduated cylinder full of water. When you do this, the object sinks to the bottom, and the water level rises by 20 ml.
What do you know about the object's...

a. Mass >20g b. Volume 20ml c. Density >1g/ml



54. Suppose you have an object A and two identical objects B. You perform some tests by dropping them into a beaker that contains 40ml of fresh water. Find the mass, volume, and density of each of the objects.



	m	V	ρ
A	5g	20ml	0.25g/ml
A+B	25g		
B	20g	10ml	2g/ml
A+2B		40ml	