Physics 102
Test 1
April 18, 2012

Name Key for 1 version of exam. other exams have same questions with different orderings.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. There are 20 questions, each quesion is worth 1 point for twenty total points in the multiple choice questions.

1) Using the example of sugar cubes shown in class, if the sides of a block are doubled in size, the surface area of the block _____ while the volume of the block _____. 1) D

A) doubles in size --- doubles in size
B) remains the same --- doubles in size
C) doesn't change in size ---- also doesn't change in size
(D) becomes four times larger in size --- becomes eight times larger in size
E) We can't answer this question unless we are told the dimensions of a sugar cube

2) Atoms are held together by 2) A

(A) the electromagnetic force.
B) the atomic force.
C) the pressure exerted by surrounding atoms.
D) the electrical interactions between the molecules in crystalline structures.
E) the binding force between protons and neutrons.

3) Of the following , which is not one of the states (phases) of normal matter? 3) E

A) solid B) liquid C) gas D) plasma (E) elastic

4) A barometer filled with mercury rises to a height of 760 mm because of atmospheric pressure. A barometer filled with water, however, rises to a height of around 10.3 meters because of atmospheric pressure. Why is this so? 4) E

A) Water is a molecule composed of one oxygen and two hydrogen atoms, while mercury is a pure substance.
B) Mercury is a little less dense than is water.
C) The water in the barometer must be ice, not liquid.
D) The pressure exerted by the mercury in the column is only around 1 pound per square inch (about 7 or 8 % that of atmospheric pressure at the surface of the Earth). while the weight of the water exerts a pressure of 1 atmosphere.
(E) Mercury is over 10 times denser than water.

5) The nucleus of an atom is composed of: 5) D

A) protons
B) neutrons
C) electrons
(D) two of the above
E) all of the above, unless the atom is ionized

6) Brownian motion 6) D

A) was discovered when pollen grains suspended in solution were viewed under a microscope.
B) arises when *invisible* neighboring atoms strike the observed particles suspended in the solution.
C) occurs only in living objects such as pollen grains; it is a property of living things.
(D) two of the above are correct
E) all of the above are correct

7) According to Archimedes' Principle 7) A

A) the weight of the fluid displaced by a floating object is the same as the weight of the object
B) changes in pressure are transmitted to all parts of an enclosed fluid
C) the volume of displaced fluid depends on the chemical make-up of the immersed object
D) we can infer that objects float if their densities are only slightly greater than the density of the fluids in which they are placed
E) we can understand why liquids seek their own levels

8) A rock weighs 5 N (5 newtons). When the same object is immersed in water, it weighs 2 N (2 newtons). What is the buoyant force on the rock? 8) C

A) 5 N
B) 2 N
C) 3 N
D) 7 N
E) None of the above are correct

9) Tension is a force that arises from 9) D

A) the compression of a solid.
B) the bending of a solid.
C) stretching of a solid.
D) two of the above are correct
E) all of the above are correct

10) The property of an atom which determines its type of chemical element is: 10) C

A) the number of electrons and protons which it contains
B) the number of particles in its nucleus
C) the number of protons in its nucleus
D) the number neutrons plus electrons in the atom
E) the number of protons in the atom minus the number of electrons in the atom

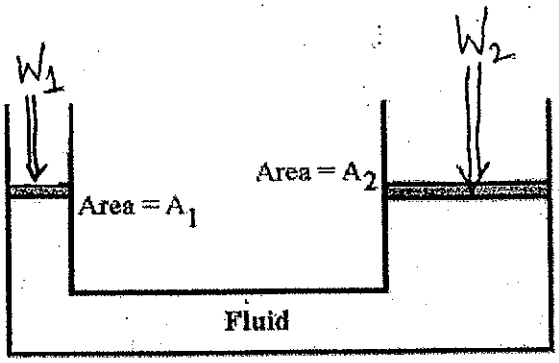
11) Atmospheric pressure 11) C

A) is due to the motions of the winds at different altitudes in the atmosphere.
B) is due to the weight of the Earth itself.
C) is due to the weight of the atmosphere which sits higher than the altitude of the observer.
D) is due to the amount of mass and volume of the atmosphere at the altitude of the observer.
E) is due to the entire weight of the atmosphere, regardless of the altitude.

12) The pressure a fish feels in the ocean 12) C

A) is determined by the type of fish; it depends on how strong is the skeleton of the fish
B) depends on whether the fish swims in the Pacific ocean or the Atlantic ocean
C) is determined only by the depth at which the fish swims
D) decreases if the fish swims in a cave rather than in open water
E) is zero. The ocean shields the fish from the atmosphere.

13) The cross-sectional areas of the arms of an U-tube are of different sizes. The left hand side has an opening area of 10 square centimeters. The right hand side has an opening area of 100 square centimeters. The U-tube is filled with fluid and caps which can slide up and down are placed over the openings of the U-tube resting on the surfaces of the fluid. Two weights are placed on the caps so that the fluid levels are the same on both sides of the U-tube. 13) B



A) We cannot determine the two weights, because water will always seeks its own level regardless of the sizes of the weights.
B) A smaller weight was placed on the left hand side of the U-tube than on the right hand side.
C) A larger weight was placed on the left hand side of the U-tube than on the right hand side.
D) We cannot tell the size of the weights because the balance depends on the density of the fluid.
E) The weights have to be the same because the pressure on the caps must be the same on both arms of the U-tube.

14) An elastic solid, such as a slightly stretched spring, is 14) A
A) a solid which returns to its original shape after it is deformed by some applied force
B) a solid which always oscillates around its equilibrium shape after it is deformed.
C) a solid which flows very slowly after it is deformed
D) a solid that maintains its deformed shape after the applied force is removed
E) a solid object that bears more resemblance to a gas than to a liquid

15) The bulk of the Universe is thought to be composed of 15) A
A) dark energy
B) exotic dark matter
C) normal matter
D) hydrogen and helium
E) quarks

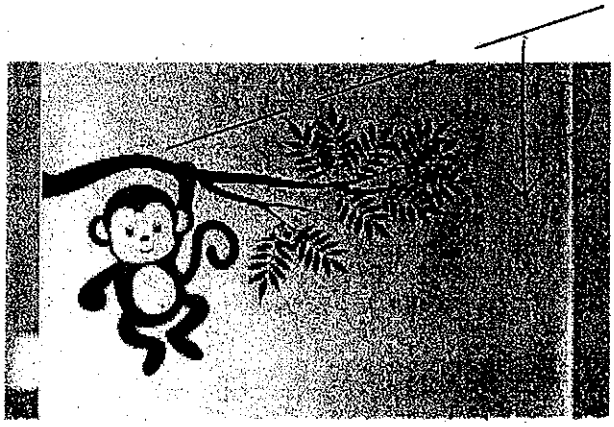
16) A hot air balloon nicely illustrates 16) A

A) Archimedes' Principle
B) Bernoulli's Principle
C) Pascal's Principle
D) Hooke's Law
E) Pascal's Vase

17) The buoyancy an object feels 17) B

A) is larger at a depth of 30 meters than it is at a depth of 25 meters.
B) is given by the weight of the fluid the object displaces.
C) makes it weigh more when it is immersed in a fluid.
D) depends on the weight of the object and the weight of the fluid it displaces.
E) helps us to understand Bernoulli's Principle.

18) Suppose a tree branch obeys Hooke's Law. If you hang an object with mass M on the branch, it bends as shown below. If you hang an object whose mass is twice that of the first object, 2 M, 18) D



A) The branch is rigid and so will bend the same amount.
B) The branch will only bend half as much as for the original mass.
C) The tree branch will bend an amount 4 times as great as for the first object.
D) The object will cause the branch to bend to an amount twice as large, 2 x D.
E) The tree branch will bend only 1/4-th as much as for the original mass.

19) The neutral layer is 19) A

A) the layer in a solid that feels no stress when the solid is bent
B) the layer in a solid composed of equal numbers of electrons and protons
C) the layer in the ocean where a medium-sized fish floats
D) the layer in the atmosphere where a person could hover above the ground
E) the layer in a solid that feels only compression if the solid is bent

20) Amorphous solids

20) E

A) do not have regular structures.
B) are unusual for a solid in that they can flow
C) are found only in rare circumstances; we never see instances of them in our ordinary lives.
D) can only form under very low temperatures, below the freezing point of water
E) two of the above are correct

Short Answers. Write your answer in the space provided. There are 20 total points available in the short answer questions.

21) Pressure and Force (4 points)

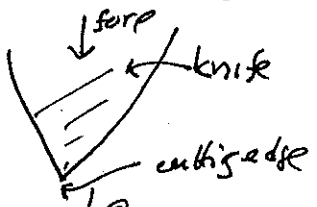
a. Describe how pressure is related to force.

pressure is the force applied per unit area

(2)

b A sharp knife cuts better than a dull knife. Explain why this is so.

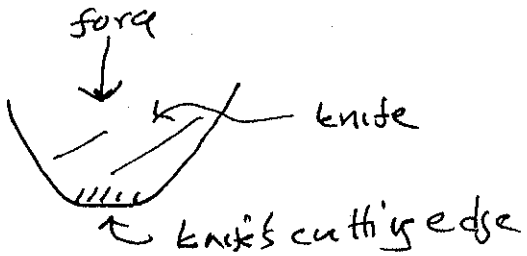
a sharp knife has a small cutting edge, e.g.,



side

(2)

a dull knife has a large cutting edge, e.g.,



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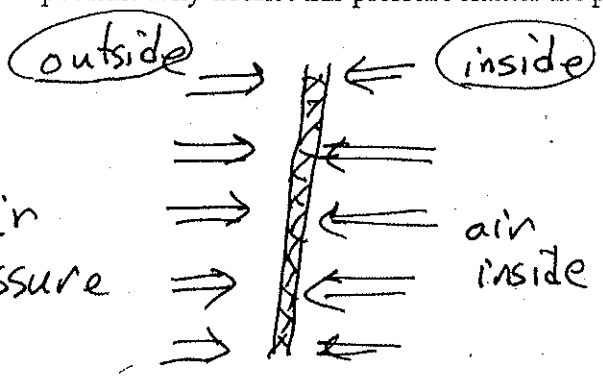
22) Bernoulli's Principle (8 points)

a. State Bernoulli's Principle

(2) the pressure in a moving fluid ~~is lower~~ decreases with an increase in the fluid's speed and increases with a decrease in the fluid's speed

b. The total force of the atmosphere pressing inward on a plate glass window of area 10 feet by 10 feet is over 200,000 pounds. Why doesn't this pressure shatter the plate glass window?

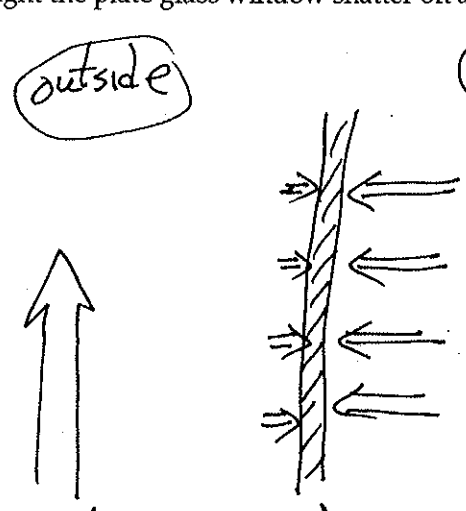
(3)



the window doesn't shatter, because the air inside the bulding exerts an equal pressure outward

c. Why might the plate glass window shatter on a day when there is a strong wind blowing past the window?

(3)



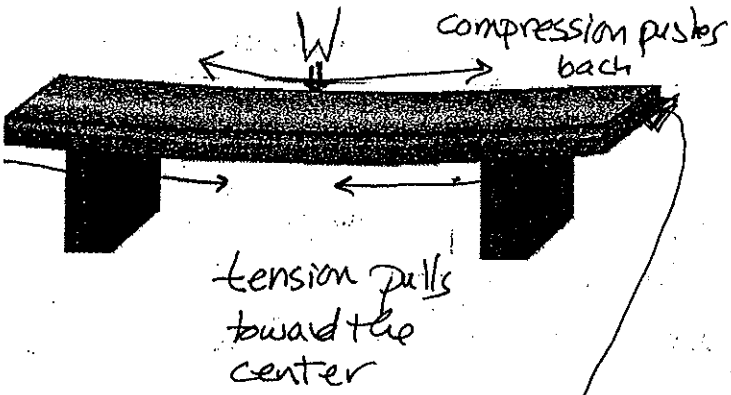
there is no wind blowing indoors so the pressure is unchanged

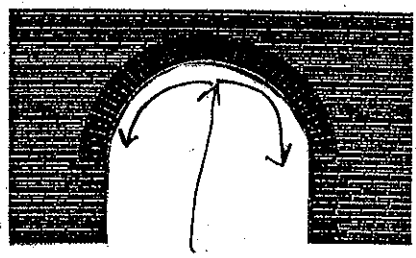
wind causes the pressure to decrease

there is now a pressure imbalance on the window

23) Tension and Compression (8 points)

A beam bridge supporting the weight W is shown to the left. An arch bridge is shown to the right.





a. Mark the directions in which the tension and compression act and indicate where the tension is the greatest and where the compression is the greatest on the beam bridge. (2)

b. What is the neutral layer? Indicate where it is on the beam bridge. (3)

the neutral layer is the layer in the beam which is not compresed and not stretched, it feels no stress.

Neutal layer

c. The arch bridge on the right can support more weight than can the beam bridge. Give a short explanation as to why this is so. To aid in your explanation, indicate on the arch bridge where the tension and compression are the greatest and the directions in which they act and whether it is tension or compression that supports the arch bridge and the beam bridge. (3)

a) the shape of the arch "directs" the compression force downward where the gromd supplies support.

b) tension is very small in the arch bridge

c) Compression supports the arch bridge, tension supports the beam bridge