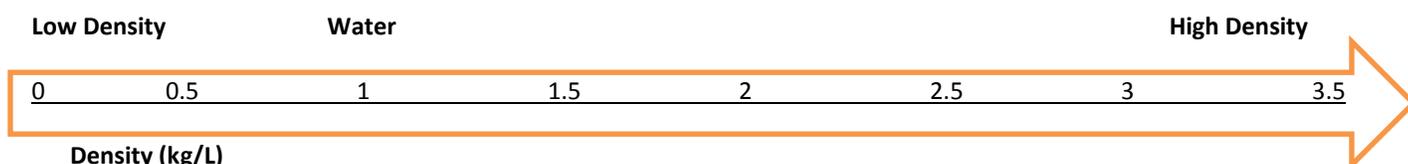


Name: \_\_\_\_\_ Group: \_\_\_\_\_

- Consider 1kg of feathers and 1 kg of gold,
  - 1 kg of gold has a smaller weight
  - 1 kg of feathers has a smaller weight
  - 1 kg of feathers and 1 kg of gold have equal weight
  - which one has a smaller weight depends on the temperature and pressure of the room.

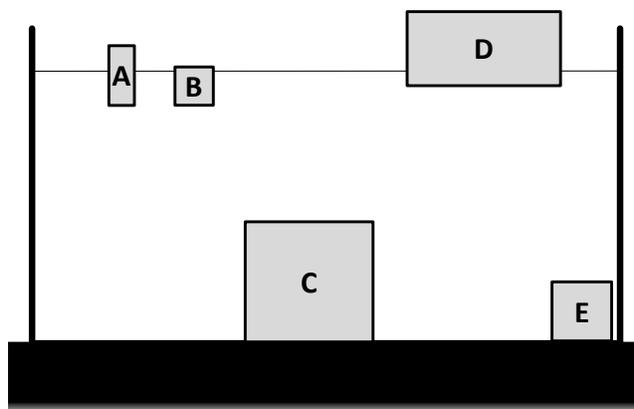


- At the point labeled "0.5" on the Density line above, it is most appropriate to write:
  - Sinks quickly
  - Barely sinks
  - Barely floats
  - Floats well
  - Not enough information

You have 5 blocks of different shapes, different sizes, and different materials. You put them in water and see that some float and some sink (see picture).

- Which of the blocks has the **smallest density**?

- Block A
- Block B
- Block D
- Blocks A, B and D
- Blocks C and E



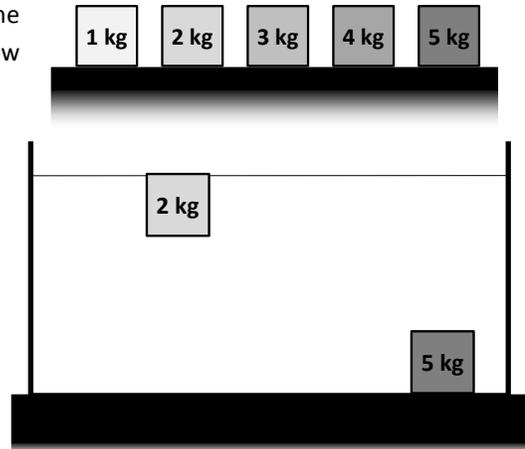
- Which of the blocks has the **largest density**?

- Block A
- Block B
- Block D
- Could be either blocks A, B or D
- could be either Blocks C or E

- If you compare Blocks C and E, which of the blocks has the **larger volume**?

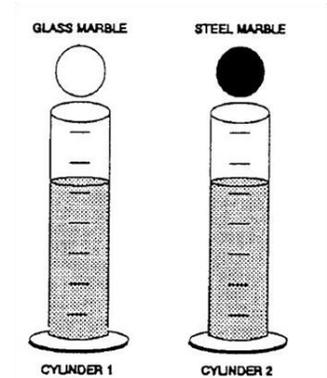
- Block C
- Block E
- Blocks C and E have the same volume
- Not enough information

You have 5 blocks that are the same size, but different masses. The lightest one is 1kg, the heaviest one is 5kg. The picture shows how the 2kg and 5kg blocks float and sink in water.



6. If you place the 3 kg block in the water, it will
- float with part of the block above the water
  - float with just the top of the block at the water
  - float at any depth it is placed
  - Sink
  - Not enough information
7. A student in lab finds that two objects have the same mass, she is sure to find that they also have the same
- weight
  - volume
  - density
  - more than one above
  - none of the above

8. The diagram to the right shows two identical cylinders filled to the same level with water. Also shown are two marbles, one glass and one steel. The two marbles are the **same size** but the steel one is much heavier than the glass one. When the glass marble is put in Cylinder 1 it sinks to the bottom and the water level rises to the 6<sup>th</sup> mark. If you put the steel marble into Cylinder 2, what will happen? The steel marble will
- float
  - sink and the water will rise to the 6<sup>th</sup> mark.
  - sink and the water will rise higher than the 6<sup>th</sup> mark.
  - sink and the water will rise but lower than the 6<sup>th</sup> mark.

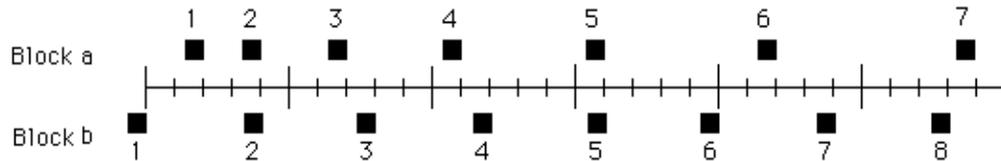


9. In the picture, some children are jumping on a trampoline, some are moving up and some are moving down. Which of these children are considered to be in free fall?
- only those moving down
  - only those moving up
  - all of them
  - not enough information



10. A student throws a baseball to a friend who's standing on the top of Ross Hall. The baseball is thrown perfectly so that it reaches the top of its flight just as it reaches the person on the roof. The baseball
- is going its maximum speed immediately after release.
  - reaches a maximum speed quite soon after release.
  - reaches its maximum speed about half way to the roof.
  - reaches its maximum speed just before the person on the roof catches it.

11. A large truck collides head-on with a small compact car. During the collision:
- the truck exerts a greater amount of force on the car than the car exerts on the truck.
  - the car exerts a greater amount of force on the truck than the truck exerts on the car.
  - neither exerts a force on the other, the car gets smashed simply because it gets in the way of the truck.
  - the truck exerts a force on the car but the car does not exert a force on the truck.
  - the truck exerts the same amount of force on the car as the car exerts on the truck.
12. The positions of two blocks at successive 1-second time intervals are represented by the numbered squares in the figure below. The blocks are moving toward the right.



The accelerations of the blocks are related as follows:

- The acceleration of "a" is greater than the acceleration of "b".
  - The acceleration of "a" equals the acceleration of "b". Both accelerations are greater than zero.
  - The acceleration of "b" is greater than the acceleration of "a".
  - The acceleration of "a" equals the acceleration of "b". Both accelerations are zero.
  - Not enough information is given to answer the question.
13. If a bar of soap is traveling on a wet floor with a constant speed, then we know
- there is a small amount of friction on the soap
  - there is a large amount of friction on the soap
  - there is no friction on the soap
  - not enough information

A bar of soap sliding on a horizontal wet floor **with constant speed** in a straight line. The soap receives a kick changing its direction. Answer the following two questions based on this information.

14. When the foot is no longer touching the soap, the main force(s) acting on the soap is (are):
- a downward force of gravity.
  - a downward force of gravity, and a force in the direction of motion.
  - a downward force of gravity, an upward force exerted by the surface, and a force in the direction of motion.
  - a downward force of gravity and an upward force exerted by the surface.
  - none. (No force acts on the soap.)
15. When the foot is no longer touching the soap, the speed of the soap:
- is constant.
  - continuously increases.
  - continuously decreases.
  - increases for a while and decreases thereafter.
  - is constant for a while and decreases thereafter.

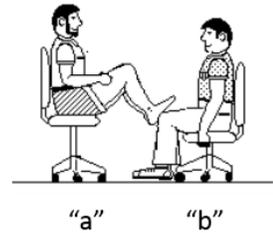
A large truck breaks down out on the road and receives a push back into town by a small compact car as shown in the figure below.



16. While the car, still pushing the truck, is speeding up to get up to cruising speed:
- A. the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car.
  - B. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.
  - C. the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.
  - D. the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the way of the car.
  - E. neither the car nor the truck exert any force on the other. The truck is pushed forward simply because it is in the way of the car.

17. In the figure, student "a" has a mass of 95 kg and student "b" has a mass of 77 kg. They sit in identical office chairs facing each other. Student "a" places his bare feet on the knees of student "b". Student "a" then suddenly pushes outward with his feet, causing both chairs to move. During the push and while the students are still touching one another:

- A. neither student exerts a force on the other.
- B. each student exerts a force on the other, but "b" exerts the larger force.
- C. each student exerts a force on the other, but "a" exerts the larger force.
- D. each student exerts the same amount of force on the other.
- E. student "a" exerts a force on student "b", but student "b" does not exert any force on student "a".

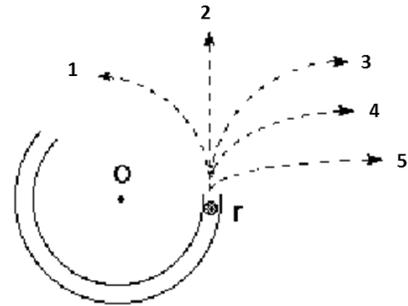


18. Josh and Taylor are standing face-to-face wearing ice skates on frictionless ice, **Josh and Taylor push off of each other at the same time**. Josh is much bigger than Taylor. After the push who is moving faster?
- A. Taylor
  - B. Josh
  - C. They move at equal speeds
  - D. Not enough information to be sure.

19. See you copy of the exam

20. A boy throws a steel ball straight up. Consider the motion of the ball only when it is no longer touching the boy's hand but before it touches the ground. Assume that air resistance is negligible. The force(s) acting on the ball is (are):
- a downward force of gravity and a steadily decreasing upward force.
  - a steadily decreasing upward force *after* it leaves the boy's hand until it reaches its highest point; on the way down there is a steadily increasing downward force of gravity.
  - a downward force of gravity and a steadily decreasing upward force *after* it leaves the boy's hand until it reaches its highest point; on the way down there is only a downward force of gravity.
  - a downward force of gravity only.
  - none of the above.

21. Which path in the figure at right would the ball most closely follow after it exits the channel at point "r" and moves across the frictionless table top?



- Path 1
- Path 2
- Path 3
- Path 4
- Path 5

22. A large box is pulled with a constant horizontal force. As a result, the box moves across a level floor at a constant speed. The pull:
- has the same magnitude as the weight of the box.
  - is greater than the weight of the box.
  - is greater than the total force which resists the motion of the box.
  - has the same magnitude as the total force which resists the motion of the box.
  - is greater than either the weight of the box or the total force which resists its motion.

23 – 30. See your copy of the exam

31. (6 pts) Explain in detail *why* objects fall at the same rate on earth if air resistance is neglected. *Hint:* There are two competing concepts at work.

32. **(9 pts)** Bonds in water and the unique properties of water.

(a) **(4 pts)** Imagine you have x-ray vision and can see the covalent bonds and the hydrogen bonds in a raindrop with your naked eyes. Draw a sketch of your vision using at least two water molecules. Label the type of bonds in your sketch.

(b) **(2 pts)** The covalent bond between the O and H atoms in a water molecule is a polar covalent bond. Explain what a “polar covalent bond” is.

(c) **(3 pts)** Other than ice being less dense than water, name another unique property of water. Describe a specific example of how this particular property makes life, as we know it, possible.

33. **(6 pts)** Elaborate why ozone is both good and bad for earthlings.

(a) **(3 pts)** Under what circumstance is ozone good for us? Briefly explain.

(b) **(3 pts)** Under what circumstance is ozone bad for us? Briefly explain.

34. **(4 pts)** Dr. Chen did a demonstration in class in which he held a piece of notecard against a coffee bottle with some water in it.

(a) **(2 pts)** Describe what happened to the notecard when he inverted the coffee bottle and let go of his hand holding the notecard.

(b) **(2 pts)** Offer an explanation of what happened.