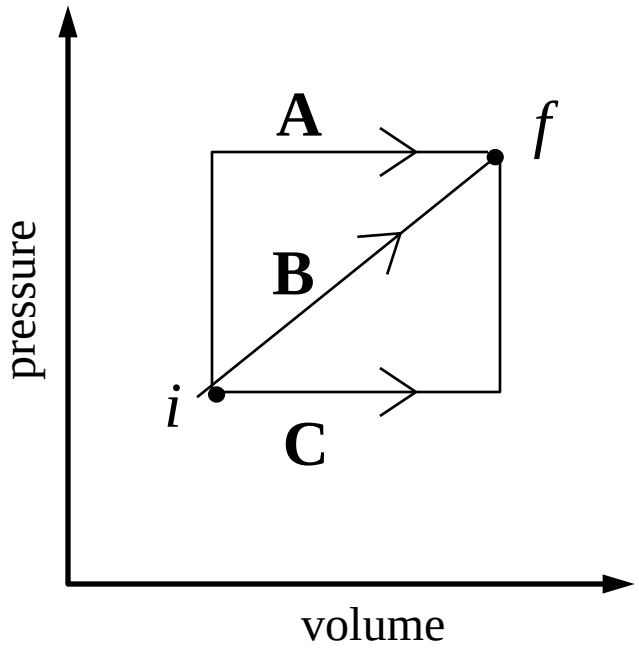
A gas is in a container with a piston lid and is taken from the state, i, to a state, f, by several different paths, **A**, **B**, and **C,** in the $P-V$ plane.



D: none of the above

The <u>work done by the gas</u> is greatest for?

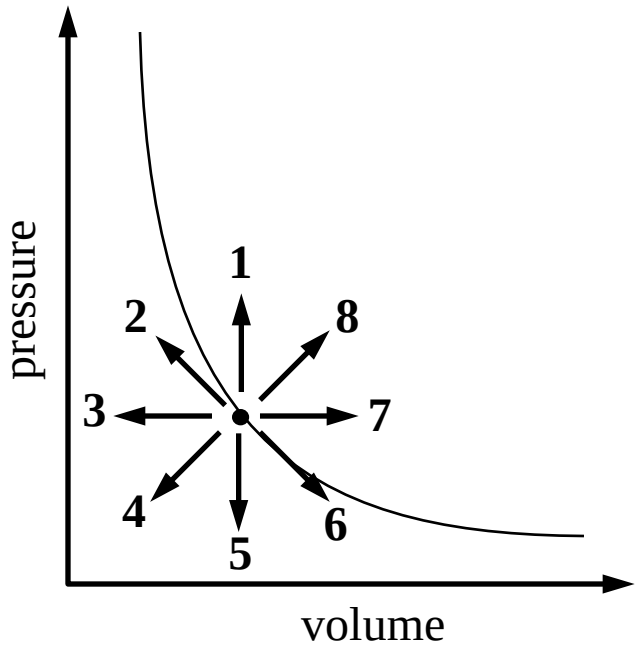
The heat added to the gas is greatest for?

The change in internal energy is greatest for?

The change in entropy is grestest for?

The change in temperature is greatest for?

The figure shows the initial state of an ideal gas and an isotherm through that state. 8 arrows mark possible paths on the $P-V$ plane



How many of these paths result in an increase in temperature of the gas?

A. 3 **B.** 4 **C.** 5 **D.** none of the previous

Which path is most nearly adiabatic?

A. 2 **B.** 4 **C.** 6 **D.** none of the previous

Which of these paths is isobaric?

A. 3 **B.** 5 **C.** 8 **D.** none of the previous

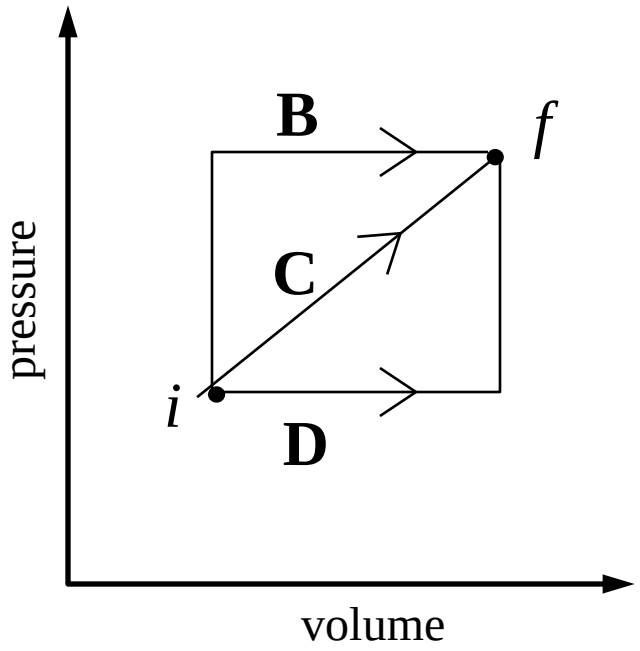
Which of these paths is isochoric?

A. 2 **B.** 5 **C.** 7 **D.** none of the previous

A quantity of an ideal gas is compressed to half its initial volume. The process may be adiabatic, isothermal, or isobaric. Rank those three processes in order of the work required, least to greatest.

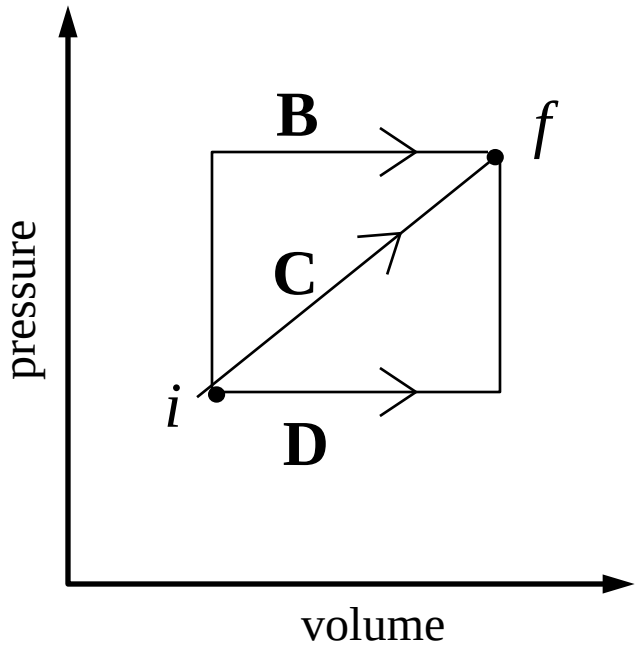
A. adiabatic, isobaric, isothermal
B. isothermal, adiabatic, isobaric
C. isobaric, adiabatic, isothermal
D. isobaric, isothermal, adiabatic

The figure shows the initial state of an ideal gas and an isotherm through that state. Which of the paths shown result in an increase in temperature of the gas?



An ideal gas is taken reversibly from state i, at temperature T_1, to another state f, at temperature T_2. Of the three processes shown on the $P-V$ diagram below, which results in the greatest change in the entropy of the gas?

A. None: they all have the same entropy change



A gas, confined to an insulated cylinder, is compressed adiabatically (and reversibly) to half its original volume. Does the entropy of the gas increase, decrease, or remain unchanged during this process?

A. increase
B. decrease
C. remain unchanged

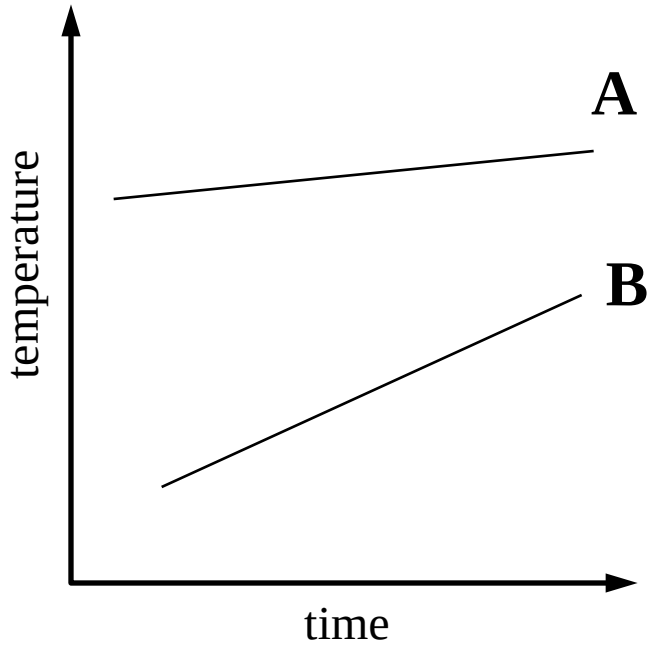
Rank, from smallest to largest, the changes in entropy of a pan of water on a hot plate, as the temperature of the water

1. goes from 20°C to 30°C
2. goes from 30°C to 40°C
3. goes from 80°C to 85°C

A. 1<2<3
B. 3<2<1
C. 3<2=1
D. 1=2<3

An electric heater is suppling heat at a rate of 1 J/s to two samples (**A** and **B**) that have the same mass. The temperature of each sample is each sample is recorded as a function of time and plotted below. Which sample has the largest specific heat?

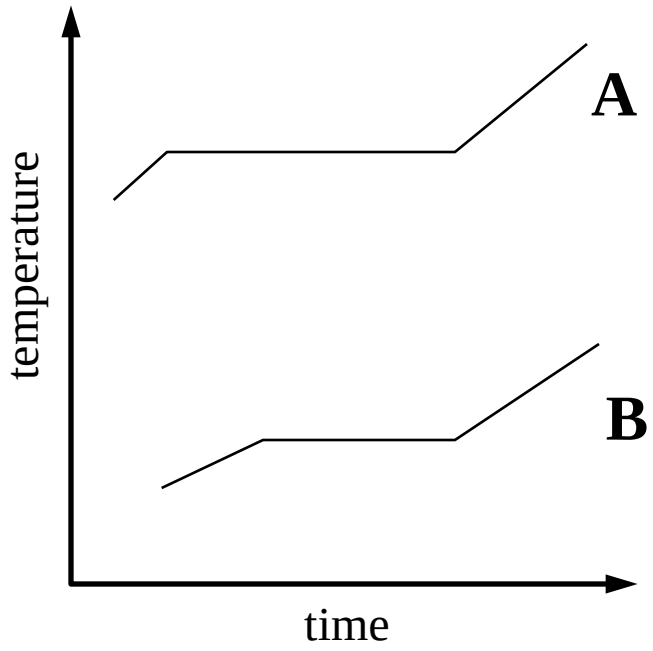
A. A
B. B
C. they are equal
D. can't tell



As above, but in this case the samples melt.

Which sample has the larger latent heat?

Which sample has the higher melting point?



10 liters of Argon at a pressure of 2 atm are in thermal equilibrium with 20 liters of Helium at a pressure of 1 atm. Which molecules have more kinetic energy, on average?

A. Argon
B. Helium
C. they have the same
D. not possible to say; additional details required

Which molecules are moving faster, on average?

Three gases with identical volumes and pressures are in thermal equilibrium. One consists of monatomic molecules, one consists of diatomic molecules, and one consists of polyatomic molecules. They remain in thermal equilibrium as the temperature is raised. The gas greatest change in internal energy is:

A. monoatomic
B. diatomic
C. polyatomic
D. the temperature change is the same so the energy change is the same.

Two objects are made of the same material, but have different masses and temperatures. If the objects are brought into thermal contact, which one will have the greater temperature change?

A. the one with the higher initial temperature
B. the one with the lower initial temperature
C. the one with the smaller mass
D. the one with the higher specific heat

Two equal−mass liquids, initially at the same temperature, are heated for the same time over the same stove. You measure the temperatures and find that one liquid has a higher temperature than the other. Which liquid has a higher specific heat?

A. the cooler one
B. the hotter one
C. both the same

You are having problems removing a metal lid from a glass jar. You can remove the lid by placing it under hot running water for a short period of time. What is the best explanation this?

A. The air inside the jar expands and pushes the lid off.
B. Metal expands more than glass for a given change in temperature.
C. The metal's thermal conductivity is greater than that of the glass
D. The metal lid softens,making the lid easier to remove.

A block of wood and a block of metal are at the same temperature.When the blocks feel cold, the metal feelscolder than the wood; when the blocks feel hot, the metal feelshotter than the wood.

A. The cold from the metal flows more rapidly to your fingers.
B. Metals are naturally cooler objects.
C. The metal can go to a lower temperature than the wood.
D. Energy can flow more rapidly between your fingers and the metal.

A pitcher contains 0.50 kg of liquid water and 0.50 kg of ice all at 0°C. You let heat flow into the pitcher until there is 0.75 kg of liquid water and 0.25 kg of ice. During this process,

A. the temperature of the ice−water mixture increases slightly.
B. the temperature of the ice−water mixture decreases slightly.
C. the temperature of the ice−water mixture remains the same.
D. The answer depends on the rate at which heat flows.

A substance that heats up relatively quickly has a

A. high specific heat.
B. low specific heat.
C. high thermal conductivity.
D. low conductivity.

Complete the following statement: Most of the heat that is lost to space from the Earth occurs by

A. conduction.
B. convection.
C. radiation.
D. a combination of two or more of the above

A system undergoes an adiabatic process in which its internal energy decreases by 20 J. We can conclude:

A. $W = 20$ J
B. $Q = 0$
C. $\Delta S = 0$
D. all of the above

During soccer practice one of your teammates sprains her ankle. You take an "instant cold pack" from the first aid box to use on her ankle. It is not at all cold when you take it out. The instructions tell you to punch the pack so that you break open a sack of chemicals inside it. When you do that you notice that the cold pack rapidly becomes quite cold. What happened?

A. By punching the pack you gave the chemicals inside the energy they needed to permit the cooling down.

B. A chemical reaction produced cold as one of its products, which cooled down the cold pack.

C. The cold pack forcefully expelled heat into its surroundings, which lowered its temperature.

D. Thermal energy was used up in forming chemical bonds, which made the cold pack colder.

In a bathroom, what can you say about the temperature of the ceramic tiles on the floor compared to the temperature of a bath mat made of a material similar to a towel?

A. The mat is at a lower temperature as it does not absorb energy well.

B. The tiles are at a lower temperature as they conduct energy well.

C. The tiles are at a lower temperature as they do not store energy well.

D. They are both at the same temperature as they have been in contact with each other for days.

The average speed of air molecules at room temperature is about:

A. zero
B. 2 m/s (walking speed)
C. 30 m/s (fast car)
D. 500 m/s (supersonic airplane)

average <u>velocity</u>?

The temperature of an ideal gas is changed from 30°C to 60°C while the volume is kept constant. How does the pressure of the gas change as the temperature is increased?

A. the pressure is cut in half
B. the pressure doubles
C. the pressure increases but by less than double
D. the pressure increases but by more than double

Two identical rooms are connected by an open doorway. The temperatures in the two rooms are maintained at different values. Which room contains more air?

A. the room with the higher temperature
B. the room with the lower temperature
C. the room with the higher pressure
D. neither: same amount of air

A greenhouse has two identical rooms (same pressure, volume and temperature). One room simulates a jungle with high humidity; the other a desert with low humidity air. Compare the density of the air in the two rooms. (ρ_J denotes the air density in the jungle room; ρ_D denotes the air density in the desert room.)

A. $\rho_J < \rho_D$
B. $\rho_J = \rho_D$
C. $\rho_J > \rho_D$

Consider two glass capillary tubes; tube **A** has half the radius of tube **B**. Let F_A denote the total surface tension force pulling the water up tube **A** and F_B the total surface tension force pulling the water up tube **B**. Which of the following holds:

A. $F_A > F_B$
B. $F_A = F_B$
C. $F_A < F_B$

A kilogram of grapes have more skin area than a kilogram of:

A. blueberries
B. apples
C. grapefruits
D. Each has the same skin area

Which one of the following temperatures is the warmest?

A. 10˚C **B.** 10 K **C.** 10°F **D.** 250 K

Which one of the following temperature changes represents the largest amount of cooling?

A. −10˚C **B.** −10 K **C.** −10°F

Which has more internal energy:

A. Lake Superior **B.** Your Instructor

Which is hotter?

During an evening news broadcast in Helsinki, Finland, the meteorologist indicated that the day's lowest temperature was −4.0 °C. What is the corresponding value of this temperature on the Fahrenheit scale?

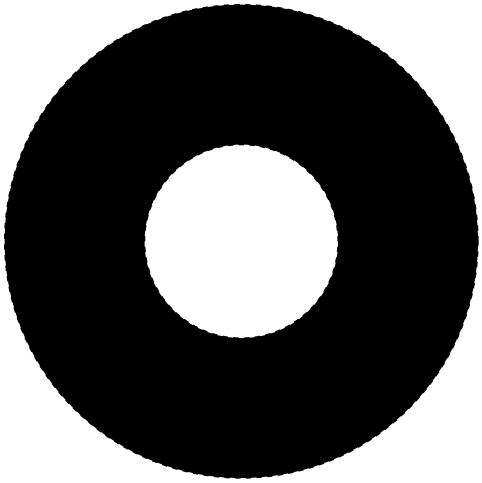
A. −7.2 °F
B. −4.0 °F
C. 17 °F
D. 25 °F

Which of the following could be said to involve heat:

A. coffee cup cooling off
B. temperature in Phoenix
C. the hocky team in Miami
D. the internal energy of Lake Superior

Consider a brass washer. When heated, does the hole in the middle of the washer:

A. Increase in radius
B. Decrease in radius
C. Stay the same size



Two identical mugs contain hot coffee from the same pot. One mug is full, while the other is only one-quarter full. Sitting on the kitchen table, which mug stays warmer longer?

A. the mug that is full
B. the mug that is one-quarter full
C. neither mug

Which one of the following statements best explains why convection does not occur in solids?

A. Molecules in a solid are more closely spaced than in a gas.
B. The molecules in a solid are not free to move throughout its volume.
C. Molecules in a solid vibrate at a lower frequency than those of a liquid.
D. Solids are less compressible than gases.

Inside a room at a uniform comfortable temperature, metallic objects generally feel cooler to the touch than wooden objects do. This is because:

A. a given mass of wood contains more heat than the same mass of metal

B. metal conducts heat better than wood

C. heat tends to flow from metal to wood

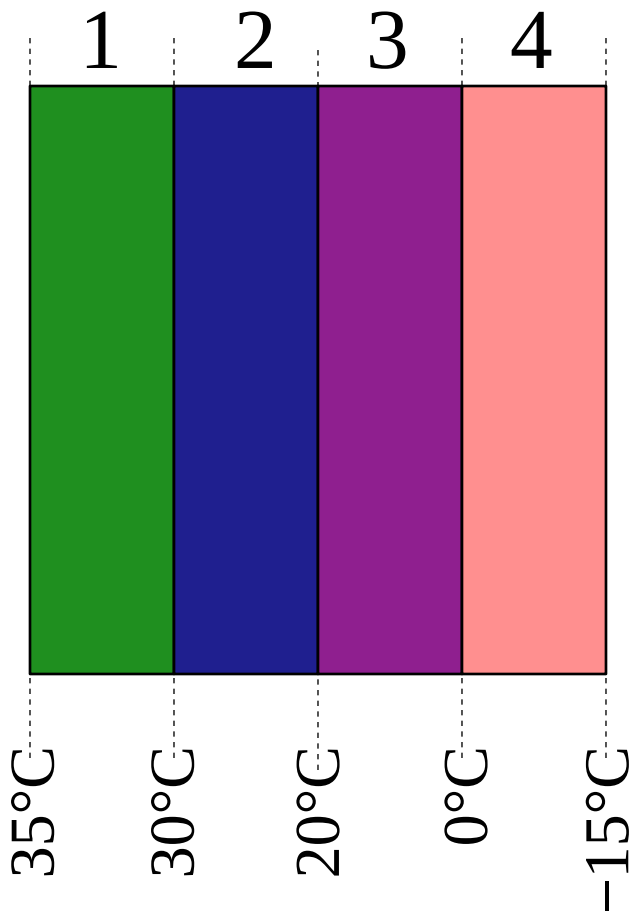
D. the equilibrium temperature of metal in the room is lower than that of wood

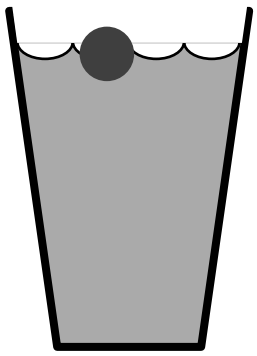
On which block, A (which feels cool to the touch) or **B** (which feels warm to the touch) will ice melt faster?

C. neither

The figure below shows four slabs of different materials with equal thickness, placed side by side. Heat flows from left to right and the steady state temperatures of the interfaces are given. Rank the materials according to their thermal conductivities, smallest to largest.

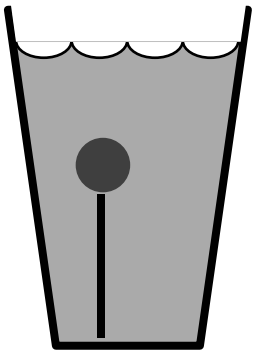
A. 1<2<4<3
B. 3<4<2<1
C. 4<3<2<1
D. none of above





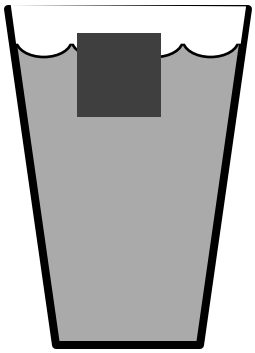
A solid ball of plastic of volume V, mass m, and density ρ_p is floating in a cup of water. (The density of water is ρ_w .) What is the buoyant force, B, on the ball?

A. $B = \rho_p V g$
B. $B = \rho_w V g$
C. $B = m g$
D. None of the above



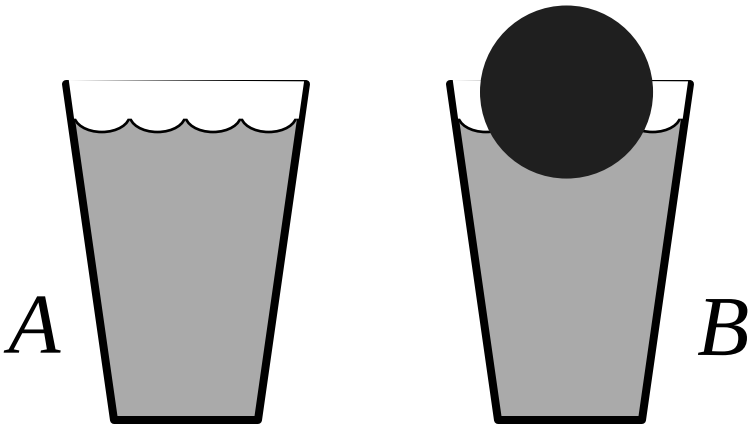
The ball of plastic is held under water by a string attached to the bottom. What is the buoyant force on the plastic ball?

A. $B = \rho_p V g$
B. $B = \rho_w V g$
C. $B = m g$
D. None of the above



An ice cube is floating in a glass of water. As the ice cube melts, the level of the water:

A. Rises
B. Falls
C. Stays the same



Two identical cups have exactly the same water level, but cup *B* has a plastic ball floating in it. (Of course *B* has less total water, since it has plastic in some places where *A* has water.) Which cup weighs more?

A. The cup without the ball.
B. The cup with the ball.
C. The two cups weigh the same.

An astronaut on earth notes that in her soft drink an ice cube floats with 9/10 its volume submerged. If she were instead on the moon, the ice in the same soft drink would float with

A. less than 9/10 submerged.
B. 9/10 submerged.
C. more than 9/10 submerged.

The inverted drinking glass filled with air is placed mouth downward in water. As it is pushed deeper, the air is compressed. How deep must the glass be pushed in order that the air be compressed to half its original volume?

At this depth, how will the buoyant force on the submerged glass compare to when it was submerged at the surface?

A. more
B. less
C. same

A boat carrying a large boulder is floating on a lake. The boulder is thrown overboard and sinks. The water level in the lake (with respect to the shore)

A. rises.
B. sinks.
C. remains the same.

A wood box falls off a boat that is floating on a lake. The box floats. As a result, the level of the water in the lake

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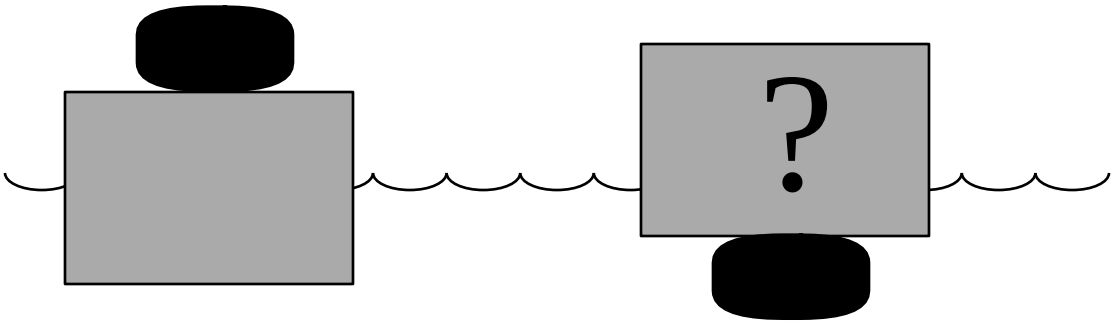
In the presence of air, the small iron ball and large plastic ball balance each other. When air is evacuated from the container, the larger ball

A block of balsa wood with a rock tied to it floats in water. When the rock is on top, exactly half the block is below the water line.



When the block is turned over so the rock is underneath and submerged, the amount of block below the water line is

A. less than half
B. half (i.e., same)
C. more than half

The water level at the side of the container will

A. rise
B. fall
C. remain unchanged

Two objects of the same volume are placed in water. Object A floats and Object B sinks. The greater buoyant force is on

A. object A
B. object B
C. both are same

Two objects of the same mass are placed in water. Object A floats and Object B sinks. The greater buoyant force is on

The Wood and Iron have equal volumes. The wood floats while the iron sinks in water. Which has the greater buoyant force on it?

A. The Wood.
B. The Iron.
C. They have equal buoyant forces on them.

Aluminum and the Lead hunks have equal masses. In water, which has the greater buoyant force on it?

A. The Aluminum.
B. The Lead.
C. They both have the same buoyant force.
D. Can’t tell without knowing their volumes.

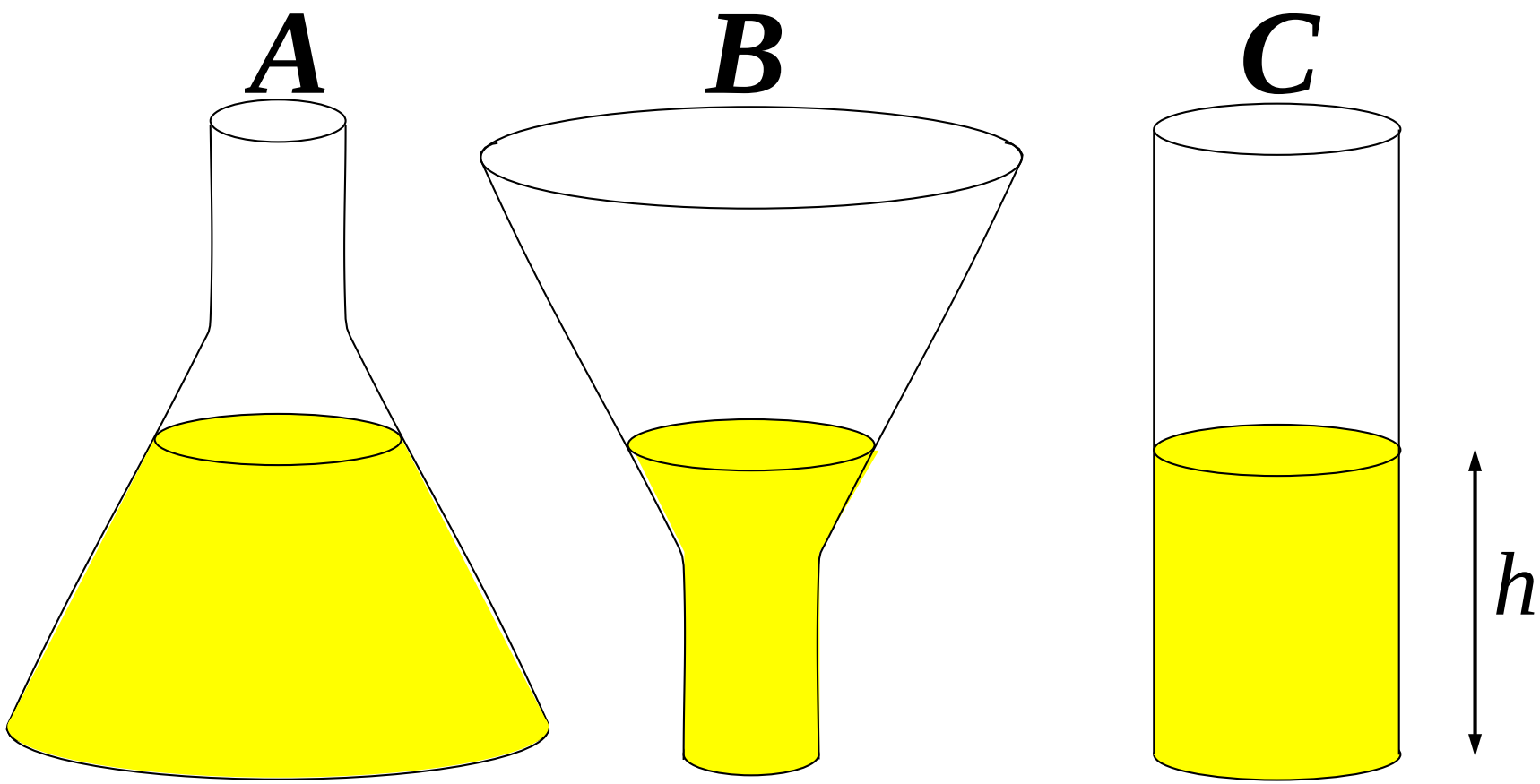
Two dams are identical in size and shape and the water levels at both are the same. One dam holds back a lake containing 2 million m^3 of water while the other hold back a 4 million m^3 lake. Which statement is correct concerning the average force on the dams?

A. The dam with the larger lake has twice the total force on it.

B. The dam with the smaller lake has twice the total force on it.

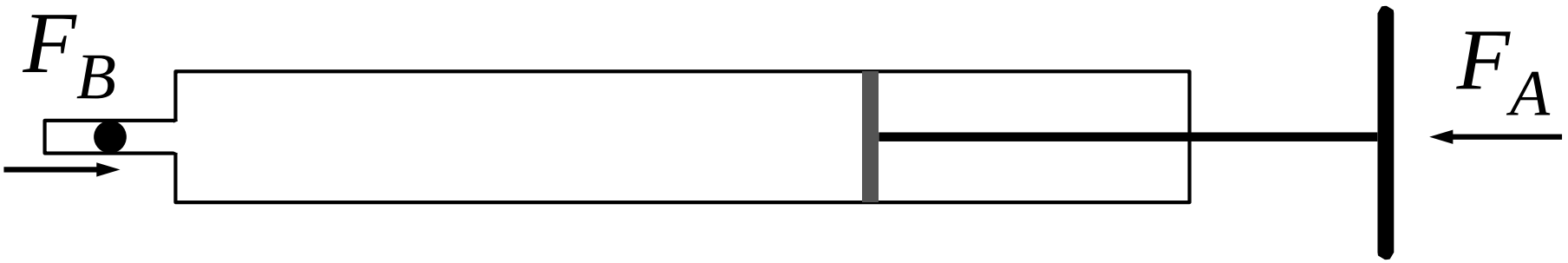
C. The dam with the larger lake has a slightly larger total force on it.

D. None of the above.



The pressure on the bottom is greatest for?

D. none of the above

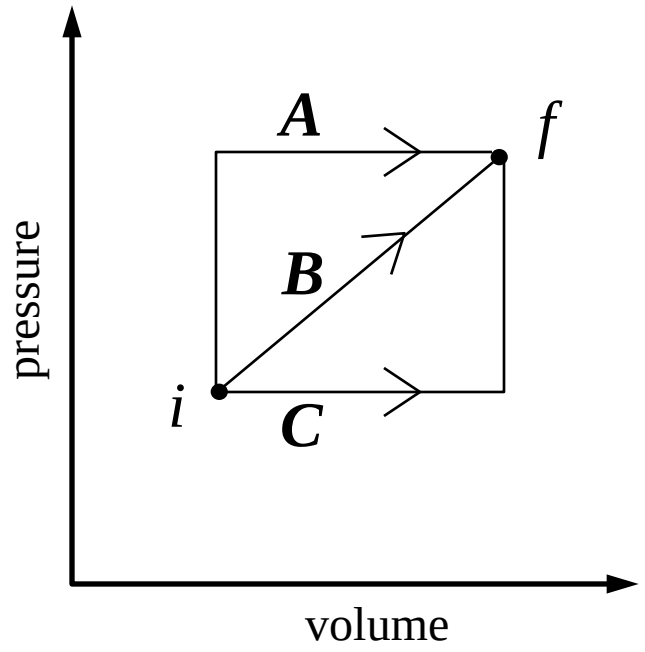


Which is larger:

A. F_A

B. F_B

C. they are the same


A
f
B
i
C
pressure
volume