

Heat & Specific Heat Practice Problems

AP Physics

Name:

Period:

Answer these questions on your own sheet of paper.

1. How is heat different from temperature? Give examples that illustrate the difference.
2. Is it possible for a material to have a negative specific heat? Explain.
3. You run an experiment where you put different odorous molecules on one side of a 50 m wide room and wait to see how long it takes to smell them on the far side. The room is at 25 °C
 - a) You start with a molecule that smells of rotten eggs – hydrogen sulfide, with 5.66×10^{-26} kg of mass. What is the shortest time it could take for a hydrogen sulfide molecule to reach the far side of the room? (Hint: how fast is the molecule moving at that temperature?)
 - b) You then use a molecule that smells of violets - dodecanol, with a mass of 3.06×10^{-25} kg. What is the shortest time it could take a dodecanol molecule to reach the far side of the room?
 - c) If you cool the room down to -100 °C, what is the shortest time it could take for a dodecanol molecule to reach the other side of the room?
 - d) Why does it normally take so much longer for smells to cross a room and reach your nose?
4. Find the amount of heat in each of the following situations:
 - a) An iron (for clothes) made of 1.2 kg of iron heats up from 20 °C to 70 °C.
 - b) All 0.6 kg of air inside an oven cools from from 250 °C to 40 °C.
 - c) Inside a microwave, 500 g of water in a measuring cups warms from 4 °C to 90 °C

5. Two 1 kg blocks – one made of lead and the other made of copper – are warmed up from 110 K to 190 K

a) Which block requires more energy to raise its temperature?

b) How much more energy does that block absorb?

6. The heating element in a toaster is a 0.25 kg tungsten wire, which starts at 25 °C. It takes 30 seconds to heat up to toasting temperature. (Assume that the toaster does not give off any energy to the air or toast as it heats up. This is ridiculous as it would make the toaster worthless, but it simplifies the situation.)

a) If the toaster is plugged into a 120 V outlet and draws 7 A of current, how much energy is transferred into the toaster?

b) How hot does the toaster get at toasting temperature?

7. While cleaning out the lab, Mr. Price finds a bunch of unidentified metal disks. In an effort to figure out what they are, he heats the disks up to 200 °C and drops them in water to see how much energy they give off. Figure out the specific heat of each disk and identify the metal if possible. Show work below.

Sample	Mass (kg)	Heat (J)	Initial Temperature (°C)	Final Temperature (°C)	Specific Heat	Material
A	0.3	-7106	200	21.7		
B	0.5	-44308	200	30.6		
C	0.2	-7942	200	21.9		
D	0.6	-45144	200	30.8		

8. While mixing pizza dough, you pour 0.3 kg of cool, 10 °C olive oil into 1 kg of water at 80 °C. What is the equilibrium temperature of the mixture?

9. After cooking some meat in a pan, you pour some water in the pan to rinse off the gunk left behind. The process is called deglazing the pan. If you put 600 g of 35 °C water into a 2 kg aluminum pan at 180 °C, what will the equilibrium temperature be?

10. You dump 0.24 kg of hardboiled eggs at 100 °C into a bowl filled with 1.5 kg of water at 20 °C. They come to equilibrium at 29.9 °C. What is the specific heat of the eggs?