

Physics

Phase Changes Homework

1. A common way to determine wind direction is to wet your finger and hold it up in the air. Explain **carefully** how this works and what it has to do with evaporation.
2. What if **all** of the molecules in a liquid were moving at **exactly** the same speed and then some were suddenly removed. Would this removal cool the remaining liquid?
3. The human body can maintain its normal temperature of 37°C even on a day when the temperature is above 40°C . How is this possible?
4. Suppose that a really, really, really tiny glass of water contains only 100 molecules. 20 of the molecules have a temperature of 20°C , 20 have a temperature of 40°C , 20 have a temperature of 60°C , 20 have a temperature of 80°C , and 20 have a temperature of 100°C . Calculate the temperature of the liquid. If the 20 fastest shaking molecules evaporate, what is the temperature of the liquid now? Explain why this demonstrates that evaporation is a cooling process.
5. A covered glass of water sits for days with no drop in its water level. Does this mean that no evaporation or condensation has taken place?
6. A popular feature inside a sauna is a collection of very hot rocks, a water bucket, and a ladle. As water is ladled over the rocks, it evaporates into steam. Does this process heat or cool the rocks? Does the presence of steam in the hot air make the people inside hotter or cooler? Explain your answers.
7. What happens to the absolute humidity of air when its temperature increases? What happens to its relative humidity? What does this have to do with how dry your skin feels inside your house in the winter?
8. You may have noticed moisture on the windows of your warm house on a cold day. Would it be possible for moisture to form on the windows of an air conditioned house on a very hot day? How would these two scenarios be different?
9. Why are icebergs often surrounded by fog?
10. Explain why clouds form over Grass Valley as the air from Sacramento rides up onto the foothills.
11. An enormous amount of water vapor changes phase to form tiny liquid water droplets in the clouds that form a thunderstorm. Does this phase change release energy or absorb it?
12. Place a jar of water on a small wooden stand within a saucepan of water so that the bottom of the jar is held above the bottom of the pan and so the top of the jar sticks out above the level of the water in the pan. If you place them onto a stove, the water in the pan will boil, but the water in the jar will not. Explain why.
13. Why does the water in a car radiator often boil explosively when the radiator cap is removed?
14. Explain why flammable liquids are even more dangerous if they're also volatile.

15. A piece of metal and an equal mass of wood are removed from a hot oven at equal temperatures and dropped onto large blocks of ice. The metal has a lower specific heat capacity than the wood. Which will melt more ice before cooling to 0°C?
16. How does melting ice change the temperature of the surrounding air?
17. Would regelation still occur if ice crystals were not open structured? Explain why or why not.
18. Why will spraying fruit trees with water before a frost help to protect the fruit from freezing?
19. The specific heat capacity of ice is about $0.5 \frac{\text{calories}}{\text{g}^\circ\text{C}}$. Calculate the amount of heat required to raise the temperature of a 2 gram ice cube from absolute zero (-273°C) to 0°C.
20. The heat of fusion for ice is $80 \frac{\text{calories}}{\text{g}}$. Calculate the amount of heat required to change a 2 gram ice cube at 0°C into 0°C water.
21. The specific heat capacity of water is defined to be $1 \frac{\text{calorie}}{\text{g}^\circ\text{C}}$. Calculate the amount of heat required to raise the temperature of 2 grams of water from 0°C to 100°C.
22. The heat of vaporization for water is $540 \frac{\text{calories}}{\text{g}}$. Calculate the amount of heat required to change 2 grams of 100°C water into 100°C steam. Which takes more energy, this last step, or the three that preceded it (questions #19-21)?
23. Complete the **Energy Changes** practice sheet.
24. 1,000,000 is which power of 10?
25. .01 is which power of 10?
26. $\frac{1}{100,000}$ is which power of 10?
27. Convert 10^4 into an everyday decimal number.
28. Convert 10^{-8} into the simplest possible fraction.
29. Convert 3,000,000 to scientific notation.
30. Convert .03 to scientific notation.
31. Convert $\frac{45}{100,000}$ to scientific notation.
32. Convert $\frac{3}{24,000}$ to scientific notation.
33. Divide 8748 by 2400, but limit your answer to the proper number of significant digits.
34. Multiply 1.25×10^{-4} by 5, but limit your answer to the proper number of significant digits.
35. Add 25.4 to 5.25×10^3 , but limit your answer to the proper number of significant digits.
36. Multiply 32 by 25, then subtract 11, but limit your answer to the proper number of significant digits