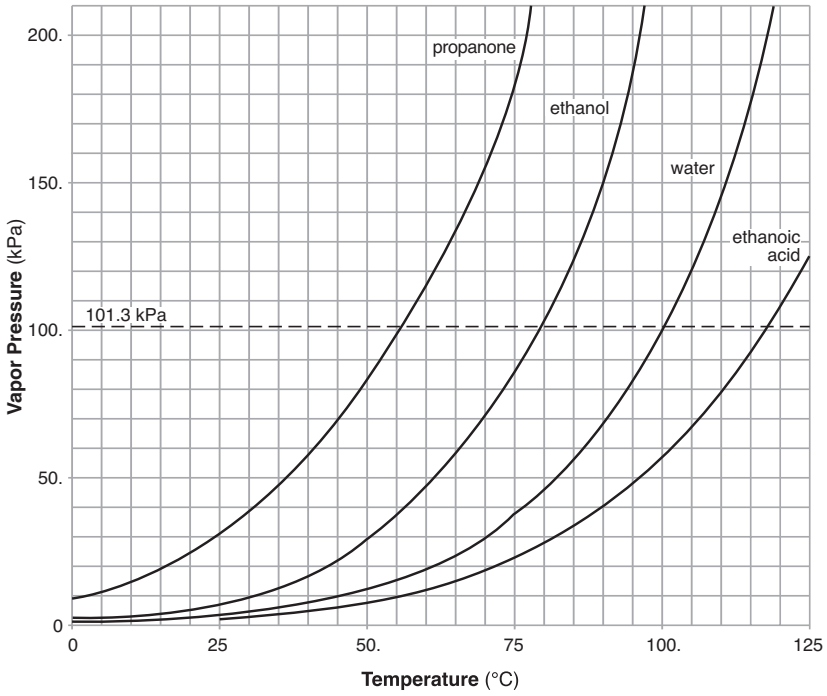
Name: _____

Vapor Pressure

Homework Unit 4 - Topic 4

An open glass of water left standing around will eventually evaporate even without being heated. When water evaporates, it changes from a liquid to a gas (water vapor). Water vapor takes up more space than an equal mass of liquid water. As a result, in a closed container, the vapor that forms can exert a significant amount of pressure. This pressure is known as vapor pressure. Even in an open container, the vapor is confined by the air pressing down on it. Some of it collects at the surface and exerts pressure. Occasional high energy molecules at the water's surface escape. That is why the water eventually evaporates. But for a water molecule to expand and form vapor bubbles throughout the liquid as it does when it boils, the vapor has to exert as much pressure as the blanket of air confining it. As a liquid is heated, more of it turns into vapor and the vapor pressure increases. When the vapor pressure reaches atmospheric pressure, the liquid boils. Under great external pressure, the liquid boils at a higher temperature.

The graph below shows the vapor pressures of four common liquids as a function of temperature. Refer to the graph to answer the questions that follow.



1. _____ Which of the substances has the lowest boiling point?
2. _____ Which of the substances has a boiling point of 100˚C?
3. _____ Which of the substances has the highest boiling point?
4. _____ Which of the substances has the highest vapor pressure at 40˚C?
5. _____ Which of the substances will boil at 79˚C?
6. _____ At what temperature will alcohol boil when the atmospheric pressure is 50 kPa?
7. _____ At what atmospheric pressure will propanone boil at 20˚C?
8. _____ At what atmospheric pressure will water boil at 90˚C?
9. _____ Which of the substances above has the lowest vapor pressure at 70˚C?
10. _____ As the pressure decreases, the boiling point of water (a) increases, (b) decreases, or (c) remains the same?
11. _____ What is the vapor pressure of water at 60˚C?

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Table H of your Reference Tables shows the vapor pressures of four common liquids as a function of temperature. Refer to Table H to answer these questions.

12. As temperature increases, vapor pressure _____. This is true for all liquids.

13. To determine the 'normal' boiling point, one would find where the vapor pressure curve intersects the pressure axis at _____ kPa. Why is this pressure value significant? _____
_____
_____

14. Estimate the vapor pressure of ethanol at 70˚C. _____ Do the same for propanone. _____

15. _____ Which liquid has the highest vapor pressure at any temperature?

16. _____ Which liquid has the weakest IMFs?

17. _____ Which liquid is the least volatile?

18. _____ What is the atmospheric pressure if ethanol is boiling at 65˚C today?

19. A student observes that the water in today's lab is boiling at 96˚C. How do explain this, since the water's normal boiling point is 100˚C? _____
_____
_____
_____

20. If a liquid is considered to be 'volatile', then it is going to have…

    1. A relatively high or low boiling point?
    2. A relatively high or low vapor pressure?
    3. Strong or weak IMFs?