Phases - Practice exam 1

1. 5.200 atm pressure needs to be converted to mm Hg and kPa.

2. 156 kPa pressure needs to be converted to mm Hg and atm.

4. Table H: what are the normal boiling points for each of the four compounds? What are their boiling points at 110 kPa?

5. What is the difference between evaporation and boiling? What is condensation?

6. Can water boil at temperatures under 100°C? Will water ever NOT boil at 110°C? Explain

7. What force holds molecules of liquids together?

8. What is STP?

9. How do heat and kinetic energy relate to each other? How do they affect gas pressures?

10. What is a barometer?

11. What is vapor pressure?

12. What is absolute zero and why is it significant?

14. Explain dynamic equilibrium in a closed system. What happens when you add heat to the system?

15. How does adding excessive pressure affect solids, liquids, and gases?

16. What is the difference between MP and FP?

17. Ionic and molecular solids have melting points. Which are higher or lower?

18. What is table H for?

19. How does a pressure cooker decrease the time needed to cook food?

20. Explain how ice in boiling water will not necessarily melt quickly.

21. What is a cooling curve? Why does the curve have a parallel line (to the lower axis)?

22. Explain how the boiling of water is actually a cooling process of the water in the beaker?

Phases - Practice exam 1 ANSWERS IN RED

1. 5.200 atm pressure needs to be converted to mm Hg & kPa. 3952 mm Hg or 526.76 kPa

2. 156 kPa pressure needs to be converted to mm Hg and atm. 1170 mm Hg or 1.53 atm

4. Table H: what are the normal B.P. for each of the four compounds?
approx.: propanone BP = 55ºC, ethanol BP = 81ºC, water BP = 100ºC, ethanoic acid BP = 118ºC
What are the B.P. for each at 110 kPa?
approx.: propanone BP = 57ºC, ethanol BP = 83ºC, water BP = 103ºC, ethanoic acid BP = 120ºC

5. What is the difference between evaporation and boiling? What is condensation?
Evaporation happens only at the surface, and at ALL temperatures, when individual molecules gain enough kinetic energy to break the intermolecular forces holding the water (or other liquid) together and overcome the air pressure. Boiling happens throughout the liquid, when many molecules gain enough energy to break from the liquid to gas phase. The bubbles are made of the gas of the liquid that's being heated. Condensation is the opposite of evaporation.

6. Can water boil at temperatures under 100°C? Will water ever NOT boil at 110°C? Explain
Yes, water boils when the temperature provides enough energy to overcome both the Intermolecular attractions AND the air pressure holding the water in the liquid phase. When you have low pressures the water boils at less than 100ºC. At high air pressures water will heat over 100ºC before it boils.

7. What force holds molecules of liquids together? Intermolecular forces, or intermolecular attraction or even intermolecular bonding.

8. What is STP? standard temperature and pressure, which are 0ºC and 101.3 kPa

9. How do heat and kinetic energy relate to each other? How do they affect gas pressures?
Heat raises the kinetic energy of a substance. The more kinetic energy present the faster the molecules or atoms of a gas will move. Molecules and atoms are able to absorb kinetic energy and this causes melting from solid to liquid, or boiling. Increased kinetic energy will speed evaporation as well. Higher kinetic energy leads to more and more powerful collisions, which gives us higher pressure.

10. What is a barometer? a device that measures air pressure.

11. What is vapor pressure? The excess pressure inside of a closed system (corked bottle) caused by the evaporation of a liquid in that system. It is affected by the temperature (hotter makes more vapor pressure) and what liquid it is (some liquids have greater intermolecular attractions and lower vapor pressure).

12. What is absolute zero and why is it significant? It is the theoretically lowest possible temperature, and is the point at which the motion of molecules and atoms ceases. Being close enough to measure this temperature would allow your energy to “warm” things up to more than 0 Kelvin. Absolute zero is a theoretical temperature, but not a real one.

14. Explain dynamic equilibrium in a closed system. What happens when you add heat to the system?
Dynamic equilibrium is when the rates of condensation and evaporation (or melting and freezing) are at a net zero. Each process continues but is equally balanced by the other. In a closed system a change in the kinetic energy will push the system in one direction or the other, and then re-establish a new level of dynamic equilibrium. Higher temperature results in higher kinetic energy, allowing for more evaporation, and then higher vapor pressure inside the closed system.

15. How does adding excessive pressure affect solids, liquids, and gases? Liquids and solids are nearly incompressible. Gases are readily compressed by pressure. Enough pressure can change a gas into a liquid.

16. What is the difference between MP and FP? Technically they are the same temperature, but solids melt to liquids, liquids freeze into solids at this temperature.

17. Ionic and molecular solids and melting point. What's the connection? Ionic solids such as NaCl have much higher melting points than molecular solids. A molecular solid would be
sucrose (table sugar).

18. What is table H for? Table H shows the way pressure and boiling points of 4 substances are connected. Table H is a sort of "Liquid - Gas" phase diagram for all four of the substances. It shows how easily these liquids evaporate. It also shows the BP at any pressure for each of the four compounds.

19. How does a pressure cooker decrease the time needed to cook food? By increasing the internal pressure because the top of the pot is locked in place, water boils at a much higher temperature than at normal pressure. This higher temperature made possible by the pressure lets food cook quicker because of higher temperatures than would be available in an open system (a pot on a stove with a regular loose fitting lid).

20. Explain how ice in boiling water will not necessarily melt. Water boils at standard pressure at 100ºC but at much lower pressures water will boil at much lower temperatures. Boiling means getting enough kinetic energy to break the intermolecular forces holding the water together, and at very low pressures, the air pressure holding the water "down" in the pot or cup is much lower, allowing water to boil at lower temperatures.

21. What is a cooling curve? Why does the curve have a parallel line (to the X axis)?
The flat part of the graph represents the time that the substance is in phase change between liquid and solid (or gas to liquid). The line must be parallel because the temperature should be stable at the MP or BP.

22. Explain how the boiling of water is actually a cooling process of the water in the beaker? The molecules of highest kinetic energy (the hottest) are the ones that escape, which lowers the average kinetic energy of the system. Once the heat is removed, cooling is more easily understood: the hottest molecules continue to leave and the system looses kinetic energy (cooling it down).