CHEM1002 Worksheet 10 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Model 1: Addition of a Strong Base to a Weak Acid

1. pH = 4.154.
2. See below.

Amount of NaOH(s) added (mol)	0.000	0.100	0.200	0.300	0.400	0.500
[CH_3COOH(aq)] (M)	0.500	0.400	0.300	0.200	0.100	0.000
[CH_3COO^-(aq)] (M)	0.000	0.100	0.200	0.300	0.400	0.500
pH	2.531	4.154	4.580	4.932	5.358	9.227*

* This value is calculated using Model 2.

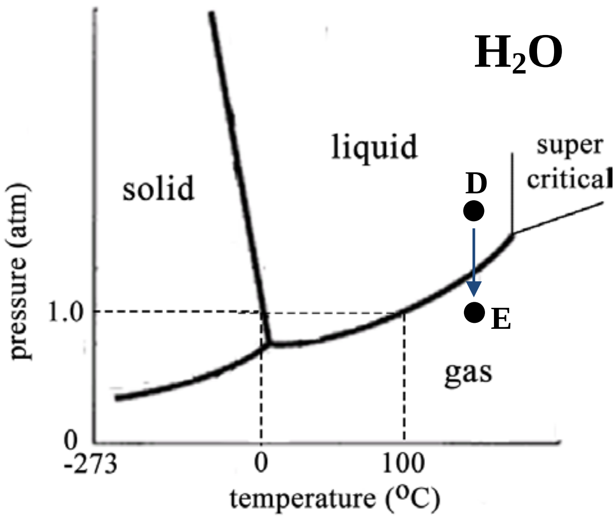
3. pH = 4.756
4. By measuring the pH when half the quantity of base needed for equivalence has been added.

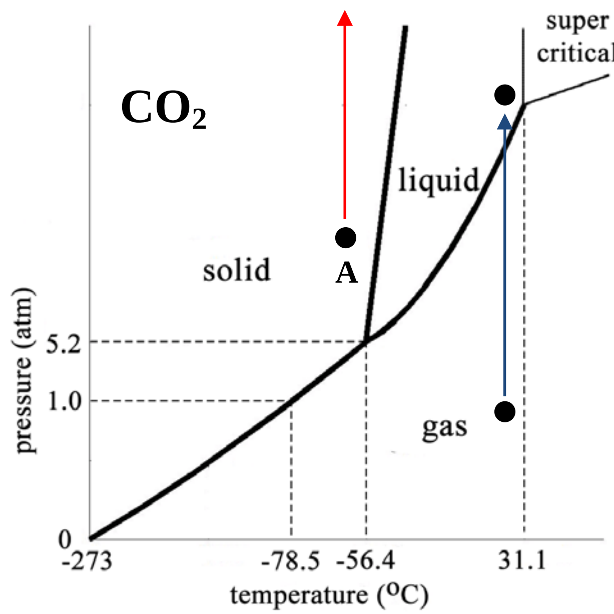
Model 2: Neutralizing a Weak Acid

1. [CH_3COO^-(aq)] = 0.500 M.
2. pH = 9.227
3. See above.
4. The solution will be neutral and the pH will be 7.
5. At equivalence, the solution contains a weak base and is basic with pH > 7.

Model 3: Phase Diagrams for Water and Carbon Dioxide

1. Liquid.
2. See H_2O diagram below. The temperature is greater than the normal boiling point so when the pressure is reduced to 1 atm, the water will boil. The person removing the radiator cap is likely to get badly scolded by the steam.
3. See CO_2 diagram below. The gas needs to be put under pressure.

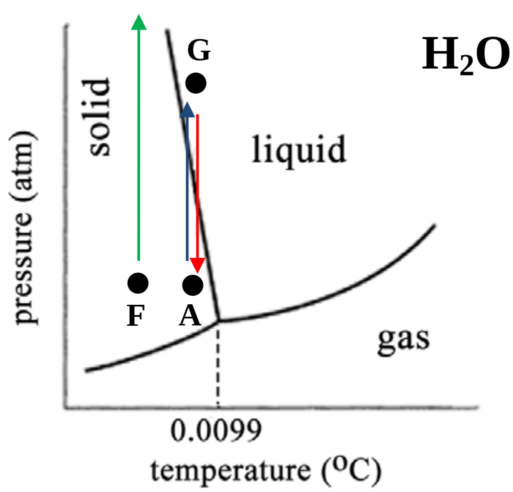




Model 4: Under Pressure

1. See blue arrow on H_2O diagram opposite. The snow will partially melt. If the pressure is continued, it may all melt.
2. See red arrow on H_2O diagram opposite. The melted snow will refreeze in a more compact and stronger structure than the original snow.
3. See green arrow on H_2O diagram opposite. A very high pressure indeed would be needed to melt the snow even at the South Pole. This could definitely not be provided by a hand so making snow balls at the Poles is not possible (without warming the snow to close to the melting point first).

   Making snowballs out of frozen water on the other worlds is sadly not possible.



4. See red arrow on CO_2 diagram above. Because of the slope of the line representing the solid – liquid transition in CO_2, the solid will never melt simply by applying pressure. Making snowballs on the other worlds out of CO_2 is sadly not possible.