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Answers

Practice exam questions

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Check your answers to the questions and activity in this issue.

Lab page: chemistry in the kitchen (pp. 7–9)

1 $CaCO_3$ (s) + H_2SO_4 (aq) → $CaSO_4$ (s) + H_2O (l) + CO_2 (g)

2 The quantity of hydrochloric acid that can be neutralised by an antacid tablet can be determined using a back titration. First, the tablet is dissolved in an excess amount of hydrochloric acid of known volume and concentration. Some of the hydrochloric acid will be neutralised by the calcium carbonate in the tablet, but there will be some remaining. A titration with sodium hydroxide, of known concentration, will determine the amount of excess hydrochloric acid. From this, we can calculate how much hydrochloric acid reacted with the antacid tablet.

3 This time allows for the white vinegar to reach the same temperature as the water in the pan.

4 A reaction can be considered as different types of particles colliding with each other, which leads to a chemical reaction. When the temperature is increased, the particles will have more energy and therefore move faster. Consequently, there will be a greater number of collisions per second, and this will speed up the rate of reaction.

However, collisions can only result in a reaction if the particles collide with enough energy to get the reaction started. The minimum energy required is called the activation energy (E_a) of the reaction. A Boltzmann distribution shows the distribution of molecular energies in a substance at constant temperature. It highlights the proportion of particles that will have energies above, and below, the activation energy (E_a). That is, it shows the proportion of particles in the sample that have enough energy for an effective collision and for a chemical reaction to take place.

Creating flavours in cheese (pp. 10–15)

1 $CH_3CH_2C(=O)OH$ and CH_3SH. In practice, this requires a different catalyst to that used in acid-alcohol esterifications.

2 To 2–3 cm^3 of each substance in a test tube:

a Add a few drops of 2,4-dinitrophenylhydrazine solution to each. This would give a yellow/orange crystalline precipitate with 3-methylbutanal, but not with the 3-methylbutan-1-ol. Tollens' reagent could be used as an alternative.

b Add 1 cm^3 of acidified potassium dichromate solution to each, and warm. The 3-methylbutan-1-ol would change colour from orange to green, no change with the 3-methylbutanoic acid.

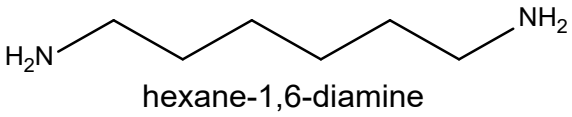
OR Add 2 cm^3 of ethanoic acid and two drops of dilute sulfuric acid to each, and warm. The 3-methylbutan-1-ol would react, forming a fruity smelling ester, the 3-methylbutanoic acid would not react.

c Add 2 cm^3 of sodium carbonate solution, or a small measure of solid sodium carbonate (or sodium hydrogen carbonate) to each. The acid would effervesce, no reaction with the 3-methylbutan-1-ol. Magnesium ribbon could be used as an alternative.

OR Add 2 cm^3 of ethanol and two drops of dilute sulfuric acid to each, and warm. The 3-methylbutanoic acid would react with ethanol forming a fruity smelling ester; the 3-methylbutan-1-ol would not react.

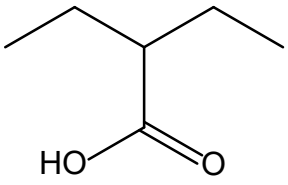
Green chemistry: modernising organic redox reactions through electrochemistry (pp. 26–29)

1

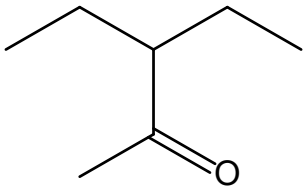


hexane-1,6-diamine

2 **a**



b



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