

Higher Chemistry – question paper 2018

Question 5

Many chemical compounds are related to each other by their structural features, the way they are made and how they are used.

Using your knowledge of chemistry, describe the relationships between fats, oils, detergents, soaps and emulsifiers. **3**

Candidate A **3 marks**

The candidate has **shown a good understanding** of the structure of fats and oils (with description of LDFs); description of the formation, structure and cleansing action of soaps; structure, and action of emulsifiers correctly described.

The diagram is mostly correct.

Candidate B **0 marks**

The candidate has **not demonstrated any understanding** of the chemistry involved at an appropriate level to be awarded a mark.

The statement that 'fats are esters' is conflicting with 'glycerol is a fat', which suggests the candidate does not understand the chemistry of fats.

Candidate C **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved, and has made some relevant statements including structure of fats and oils, emulsifiers, with example structure of detergents and soaps.

There is some confusion with regard to the structure of oils and some incorrect chemistry, eg emulsifiers making an ester bond and heads of soap molecules burying into grease.

Candidate D **1 mark**

The candidate has **demonstrated a limited understanding** of the chemistry involved.

The candidate has correctly described the structure of soaps with a confused description of cleansing action.

The description of fats and oils as 'packing in saturates ...unsaturates' suggests a lack of understanding.

Candidate E **3 marks**

The candidate has **demonstrated a good understanding** of the chemistry involved.

Condensation is identified as the reaction to make fats/oils from glycerol and fatty acids. Making soaps using sodium hydroxide is stated. The use of emulsifiers is mentioned. Linking the types of molecules through the product of hydrolysis is identified.

Candidate F **0 marks**

The candidate has **not demonstrated any understanding** of the chemistry involved at an appropriate level to be awarded a mark.

Although the candidate mentions fats and oils as part of the ester group, the mention of polarity shows a lack of understanding.

Candidate G **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

The candidate has shown an understanding of the structure of fats and oils, of the formation and structure of soaps, and has stated that detergents do not produce scum in hard water.

The description of the cleansing action of soaps is incorrect, as is the description of emulsifier action.

Candidate H **1 mark**

The candidate has **demonstrated a limited understanding** of the chemistry involved.

The candidate has briefly described the structure of soaps and detergents and emulsifiers. They have attempted to compare fats and oils structure, but this lacks depth. A brief statement of how emulsifiers and soaps work is provided (some confusion of the relative solubility of the hydrophilic head ('other than water') suggest lack of understanding).

Candidate I **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

The candidate has provided a brief statement on the structure of fats and oils. They have identified the similar structural features of soaps, detergents and emulsifiers, and that detergents are used in hard water.

Candidate J**2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

The candidate has described the structure of fats and oils and resultant differences in packing. They have stated that soaps can be made by alkaline hydrolysis. The description of the structural features of detergents and soaps, and the formation of emulsifiers is confused, with some errors in the description of detergents (double bonds) and definition of hydrophobic/hydrophilic.

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Question 10

The molar volume (in units of litres per mole) is the same for all gases at the same temperature and pressure.

Using your knowledge of chemistry, suggest how the molar volume of gases could be measured and compared. Any suitable chemicals and apparatus can be used. Some suggested chemicals and apparatus are given below.

<i>Chemicals</i>	<i>Apparatus</i>
hydrochloric acid	gas syringe
zinc	measuring cylinder
magnesium	delivery tube
calcium	stoppers
<i>water</i>	500 cm ³ flask
sodium carbonate	vacuum pump
calcium carbonate	balance
cylinder of hydrogen	burette
cylinder of carbon dioxide	filter funnel

3

Candidate A **0 marks**

The candidate has **not demonstrated any understanding** of the chemistry involved at an appropriate level to be awarded a mark.

Although a selection of apparatus was made that would work to measure gas volume, no attempt to describe an experiment that would produce gas was given. There is no description of how molar volume could be measured. No understanding of the concept of molar volume has been demonstrated.

Candidate B **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

An experiment for the production and collection of gas is described, with a correct diagram showing an efficient way to capture all gas from the experiment (thistle funnel). A balanced

equation has been attempted for the reaction described. A link has been made to the number of moles of reactant to the volume of gas produced.

Candidate C **0 marks**

The candidate has **not demonstrated any understanding** of the chemistry involved at an appropriate level to be awarded a mark.

A word equation for a reaction that would produce a gas is given. Several pieces of apparatus are selected from the given list but no description of use is offered.

Candidate D **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

The candidate describes the calculation of molar mass for carbon dioxide and nitrogen, and weighing out exactly one mole of each gas. The subsequent measurement of the volume taken up by one mole of gas is described.

Candidate E **3 marks**

The candidate has **demonstrated a good understanding** of the chemistry involved.

Correct balanced equations for reactions that would produce gases are given. Collection and measurement of gas from the reaction is correctly described with diagrams. Molar volume relationship is given with correct sample calculations included.

Candidate F **1 mark**

The candidate has **demonstrated a limited understanding** of the chemistry involved.

The method of collecting and measuring gas from the reaction of zinc with hydrochloric acid is described with diagrams. A correct balanced equation for the reaction is given. No mention of relationship to moles of reactants used and gas produced is offered.

Candidate G **2 marks**

The candidate has **demonstrated a reasonable understanding** of the chemistry involved.

The relationship between moles of gas and volume is described. Gas collection and measurement is described for soluble and insoluble gases. A decent attempt to show how molar volume could be calculated from the mass of one mole to the volume of gas collected has been made.

Candidate H**1 mark**

The candidate has **demonstrated a limited understanding** of the chemistry involved.

Experiments that would produce a gas are described. The method of collection and measurement of the gas are described with a diagram. Molar volume relationship is given.