1(a). Butanol, C_4H_9OH, is another alcohol.

Butanol burns in oxygen to make carbon dioxide and water.

Write a balanced chemical equation for this reaction.

[3]

(b). Kate and William decide to make some ethanol.

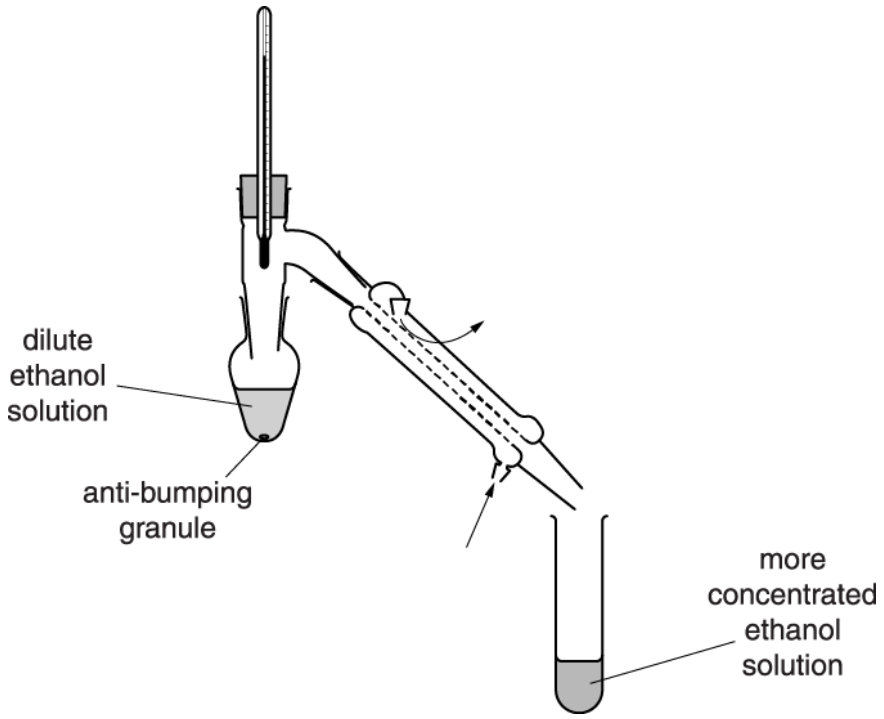
Ethanol is an alcohol.

They add yeast to sugar solution and leave it to ferment.

This makes a dilute solution of ethanol.

Kate and William decide to make their dilute ethanol solution more concentrated.

They use this apparatus.



Describe how they use this equipment to make their dilute ethanol solution more concentrated, and why it works.

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The quality of written communication will be assessed in your answer.

[6]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		$C_4H_9OH + 6O_2$? $4CO_2 + 5H_2O$	3	correct formulae for reactants & products correct numbers on RHS [on correct formulae] correct numbers on LHS [on correct formulae] correct multiple on complete equation[3] $2C_4H_9OH$ + incorrect O_2 ? $8CO_2 + 10H_2O$ [2] Examiner's Comments The balancing of the butanol equation was very well attempted, the weakest candidates gaining credit for writing the correct chemical species, the more able going on to balance the equation itself. Many candidates were able to put the correct numbers into the right hand side of the equation, the left hand side was, unsurprisingly, more difficult. Candidates who doubled the quantities for the equation were not penalised.
	b		[Level 3] Gives operational points AND theoretical points which describe the distillation including a reference to BPt difference [from water]. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Gives operational points AND theoretical points which describe the distillation. OR Makes reference to BPt and operational OR theoretical points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Gives indicative points which describe the distillation. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)	6	This question is targeted at grades up to C CHECK FOR INFORMATION ON THE DIAGRAM Indicative operational points may include: • boil / heat [the dilute ethanol] • antibumping granules control the boiling • condenser used • [condenser] is cold / cooled / water flows through • use of thermometer • keep the liquid that collects around the boiling temperature of the alcohol • stop when temp too high Indicative theoretical points may include: • boiling points different / boiling point of alcohol lower than water • gas / vapour / evaporation [of ethanol] • vapour contains both alcohol and water • [vapour] richer in alcohol • [Vapour] condenses / turns to liquid [in the condenser]

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Question			Answer/Indicative content	Marks	Guidance
			[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		• vapour contains increasing amounts of water as distillation proceeds If answer includes incorrect points (e.g. BPt of ethanol higher than water) then consider quality of communication to be impeded at levels 2 and 3 Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments Candidates gave good explanations of alcohol distillation and discussed the difference in boiling point between alcohol and water. However, there was often confusion between the use of a condenser in this context and its use for refluxing. Other candidates recalled their notes indiscriminately and described fractionating columns. Weaker candidates had great difficulty in describing what happens in a condenser.
			Total	9	

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