Website: contoureducation.com.au | **Phone:** 1800 888 300
Email: hello@contoureducation.com.au

VCE Chemistry ¾
AOS 1 Revision I [1.11]
Test Solutions

20 Marks. 2 Minutes Reading. 17 Minutes Writing.

Results:

Test Questions	_____ / 15
Extension	_____ / 5

Section A: Test Questions (15 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

Statements	True	False
a. An exothermic reaction is characterised as always having an activation energy (Ea) greater than the magnitude of enthalpy change (ΔH).		✓
b. The only case where the data book cannot be used when writing a thermochemical equation is if the conditions are not at SLC.		✓
c. The general purpose of both calorimetry and the spirit burner experiment are the same: to determine the heat of combustion of a particular fuel or food.	✓	
d. If it is known that 60% of the heat released by a fuel was lost during a practical, then the fuel's true ΔH value is 2.5 times greater than what was initially calculated.	✓	
e. The calibration factor is not necessarily needed when using a calorimeter to determine the heat of reaction of a particular reaction occurring in that calorimeter.		✓
f. Bioethanol is produced via anaerobic fermentation by bacteria.		✓
g. A major reason as to why fossil fuels are used in society as opposed to biofuels is due to the fact that they are typically less oxidised.	✓	
h. The process by which humans obtain energy from proteins is known as cellular respiration.		✓

Space for Personal Notes

Question 2 (6 marks)

Joe was playing around in his chemistry class. He was experimenting with a calorimeter by bubbling in ammonia gas, and watching it dissolve in the water.

a. If Joe sees the thermometer's temperature drop, state whether the reaction of ammonia gas dissolving in water is an endothermic or exothermic process. Justify your answer. (1 mark)

As the thermometer's temperature dropped, this means the surroundings became cooler. This must have happened because the system/reaction absorbed heat/energy, making it endothermic.

b. If Joe bubbled 10.4 g of NH_3 into the calorimeter and observed the thermometer's reading go from 25.0°C to 21.5°C, and his teacher tells him that this particular calorimeter had a calibration factor of 20 $kJ/°C$, write the **thermochemical** equation for the process taking place. (3 marks)

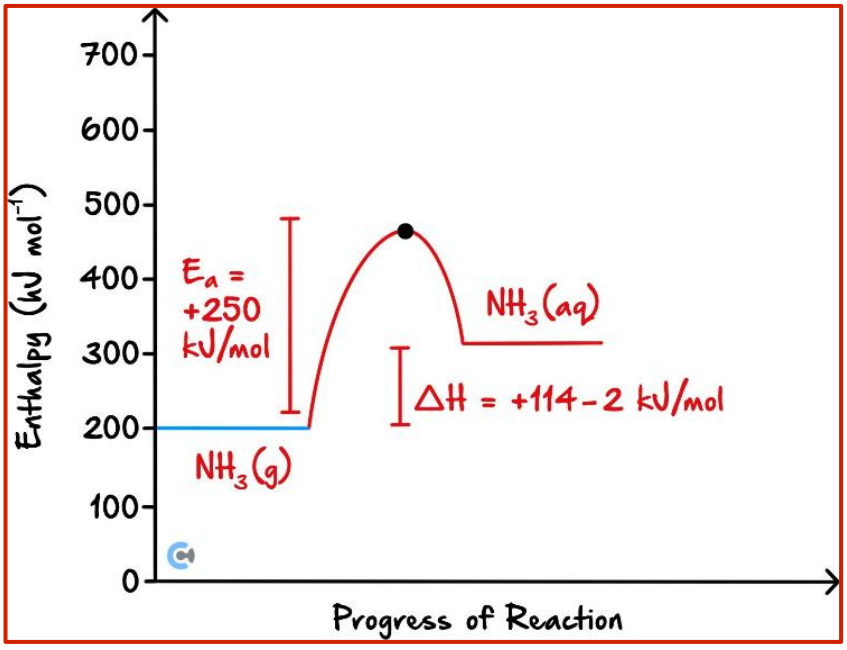
$n(NH_3) = m/M = 10.4/17.0 = 0.612\ mol$

$E = CF \times \Delta T = 20 \times (25 - 21.5) = 70\ kJ$ (1)

$\Delta H = q/n = 70/0.612 = +114.4\ kJ/mol$ (2)

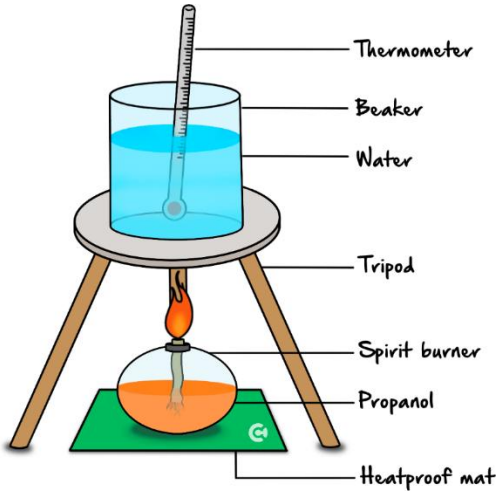
$$NH_3(g) \xrightarrow{H_2O(l)} NH_3(aq) \quad \Delta H = +114.2\ kJ/mol$$ (3)

c. If the energy required to break the bonds in the reactant molecules is known to be 250 kJ/mol, complete the following energy profile diagram. Ensure to label the reactants and products, as well as the activation energy, Ea, and ΔH values. Use your ΔH value from **part b**. (2 marks)



Question 3 (5 marks)

The following set up was constructed by Om to determine the heat of combustion of propanol, C_3H_7OH, as it is not found in the literature available to him at school.



a. Write the full balanced equation for the complete combustion of propanol at SLC. (1 mark)

$$C_3H_7OH(l) + O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

b. If he measures the mass of the spirit burner as $52.2\ g$ after the experiment but it was $55.5\ g$ before the practical, calculate the amount, in mol, of propanol combusted. (1 mark)

$$\Delta m = 55.5 - 52.2 = 3.3\ g$$
$$n(\text{propanol}) = m/M = 3.3/60.0 = 0.055\ mol$$

c. Given that the temperature of the $250\ mL$ of water started at $25°C$, and increased by $10.0°C$ before turning the spirit burner off, calculate the energy absorbed by the water, in kJ. (1 mark)

$$q = mc\Delta T = 250 \times 4.18 \times 10.0 = 10450\ J = 10.45\ kJ$$

d. If Om knows that only 35% of the heat released by the propanol was absorbed by the water, calculate the theoretical molar heat of combustion of propanol. (2 marks)

$$q(\text{released}) = q(\text{absorbed})/0.35 = 10.45/0.35 = 29.86\ kJ$$
$$\Delta H = \frac{q}{n} = \frac{29.86}{0.055} = -542.86\ kJ/mol$$

Section B: Extension (5 Marks)

Question 4 (5 marks)

Petrol is commonly used in motor vehicles as an energy source. Recently, however, a blend between ethanol and petrol, E10, is growing popularity due to the sustainable production of ethanol.

a. Outline the process by which petrol is obtained. (1 mark)

Drilling under ocean beds to obtain crude oil; fractional distillation to obtain octane.

b. In terms of fuel performance, state which of the two alternatives, petrol or E10, drivers would prefer. Explain your reasoning. (2 marks)

Ethanol is partially oxidised, and thus, cannot release as much energy per gram as hydrocarbons can. Therefore, petrol would be more appropriate for fuel performance.

c. Your eco-friendly uncle - who does not study VCE Chemistry - asks you the following question: "Even if we had a motor fuel which was pure ethanol, would it not still be harmful to the environment as it releases net CO_2 emissions upon combustion?" Detail a valid response to your uncle, ensuring to include any relevant equations. (2 marks)

While it is true that CO_2 is produced upon combustion, the plants used in sourcing bioethanol offset this fact as they absorb CO_2 via photosynthesis: $6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$ (chlorophyll and UV light above arrow), so overall it is (mostly) carbon neutral, barring transport and farming equipment.

Space for Personal Notes

CONTOUREDUCATION

Website: contoureducation.com.au | **Phone:** 1800 888 300 | **Email:** hello@contoureducation.com.au

VCE Chemistry ¾

Free 1-on-1 Support

Be Sure to Make The Most of These (Free) Services!

- Experienced Contour tutors (45+ raw scores, 99+ ATARs).
- For fully enrolled Contour students with up-to-date fees.
- After school weekdays and all-day weekends.

1-on-1 Video Consults	Text-Based Support
➢ Book via bit.ly/contour-chemistry-consult-2025 (or QR code below). ➢ One active booking at a time (must attend before booking the next).	➢ Message +61 440 137 304 with questions. ➢ Save the contact as "Contour Chemistry".

Booking Link for Consults
bit.ly/contour-chemistry-consult-2025

Number for Text-Based Support
+61 440 137 304