

Question 7 (Answer: **A**)

- Carbon needs four bonds, oxygen two, and each hydrogen one.
- In CH_3OH the carbon bonds to three hydrogens and to the oxygen; the oxygen bonds to that carbon and to one hydrogen.
- The oxygen also keeps two lone pairs, so check those are drawn.

4(a)(i)	- rates are equal - concentrations are no longer changing				
4(a)(ii)	<table border="1"> <tr> <td>M1 decreases</td><td>M2 decreases</td></tr> <tr> <td></td><td>M3 no change</td></tr> </table>	M1 decreases	M2 decreases		M3 no change
M1 decreases	M2 decreases				
	M3 no change				
4(a)(iii)	forward reaction is exothermic				
4(b)	USUAL METHOD M1 2490 M2 2670 M3 -180 ALTERNATIVE METHOD M1 850 M2 1030 M3 -180				
4(c)	M1 3 dot and cross bonding pairs M2 one lone pair on the N atom (to complete the N octet) M3 three lone pairs on each Cl atom (to complete each Cl octet)				
4(d)(i)	M1 solid disappears M2 effervescence/bubbling/fizzing				
4(d)(ii)	M1 $0.005 \div 5 \times 10^{-3}$ (mol) M2 $0.0025 \div 2.5 \times 10^{-3}$ (mol) M3 60 (cm^3)				

4(a)	M1 3 dots and 3 crosses shared M2 one non-bonding pair of 2 dots on one N atom and 2 crosses on the other N atom to complete the octet on both
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4(b)(i)	Conditions can be in any order M1 (temperature) 450 and °C M2(pressure) 200 and atmospheres / 20 000 and kPa M3 iron and catalyst
4(b)(ii)	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
4(c)(i)	5 O ₂ → 4 NO + 6 H ₂ O
4(c)(ii)	M1 –3 M2 +2
4(c)(iii)	increase in oxidation number
4(c)(iv)	$4\text{NO} + 3\text{O}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{HNO}_3$ M1 HNO₃(1) M2 equation completely correct
4(d)	M1 15 M2 7.5 M3 990

2(a)	M1 pair of electrons M2 electron(s) shared between two atoms
2(b)(i)	M1 the oxidation number of chlorine / <i>Cl</i> M2 (oxidation number) is +1
2(b)(ii)	M1 O with 1 dot-cross bonding pair with each <i>Cl</i> M2 4 non-bonding dots for O M3 6 non-bonding crosses for each <i>Cl</i>
2(b)(iii)	M1 (forces of) attraction between molecules are broken (during boiling) M2 covalent bonds (between <i>Cl</i> and O atoms) are broken (during thermal decomposition) M3 weak attraction between molecules and strong covalent bonds / bonding between atoms correctly applied
2(b)(iv)	M1 no ions M2 no mobile electrons
2(c)(i)	graphite
2(c)(ii)	electrons
2(c)(iii)	M1 5 correct Si atoms M2 4 correct O atoms

Question 7 (Answer: C)

- Each shared pair must sit between the two atoms, drawn as one dot and one cross.
- Hydrogen needs exactly two electrons in its shell; chlorine and nitrogen need eight.
- So check every atom ends with a complete outer shell and no shared pair is counted twice.