Question	Marking Guidance	Mark	Comments
8.1	**M1** no effect (on yield) **M2** increases rate / speed of both / forward and reverse reactions <u>equally / by the same amount</u>	1 1	CE = 0 if yield changes If no reference to effect on yield, could still score **M2** Ignore reference to no change in position of equilibrium, and reference to lowering activation energies **M2** allow changes rate of both / forward and reverse reactions <u>equally / by the same amount</u>
8.2	$(K_c =) \frac{[CH_3OH]}{[CO][H_2]^2}$	1	Must be square brackets Ignore state symbols Ignore units
8.3	**M1** divides moles by volume (0.250 or $\frac{250}{1000}$) **M2** $K_c = \frac{\frac{0.0610}{0.250}}{\left[\frac{0.340}{0.250}\right]\left[\frac{0.190}{0.250}\right]^2} \left(= \frac{0.244}{1.36 \times 0.76^2}\right)$ **M3** 0.311	1 1 1	Correct answer scores 3; **M3** to at least 2sf (0.3106159 …); ignore units Allow ECF from **M1** to **M2** if an attempt to calculate concentration has been made by dividing by some factor of 250 cm^3 Allow ECF from **M2** to **M3** for use of an expression containing each reagent in a correctly substituted K_c expression If volume not used, then allow **M3** only for 4.97 (4.96985 … to at least 2sf)

8.4	**M1** $\frac{1}{Answer\ to\ 8.3}$ = 3.22 **M2** $mol^2\ dm^{-6}$	1 1	**M1** to at least 2sf (0.31 gives 3.2(258)) **M1** = 1.21 if alternative answer to 8.3 used If an error was made in 8.3, but the candidate produced an answer in 8.4 that did fit the inverted calculation from 8.3, then candidate could score **M1** (if volumes are not used, then candidate would get 0.20(12.)