Question 15 (Answer: **A**)

- The acid and both reactants are liquids, so the catalyst is in the same phase – homogeneous.
- A catalyst offers an alternative pathway, and that same lower-energy pathway serves the reverse reaction too.
- So it lowers the activation energy in both directions; both statements are correct.

Question 14 (Answer: **C**)

- A catalyst adds no energy, so it cannot change the average energy or the distribution – A and B are wrong.
- It lowers the activation energy by offering a different route.
- With a lower barrier, a greater proportion of the particles already present have enough energy to react.

2(a)	**M1** Al_2O_3 is ionic **M2** P_4O_{10} is a (simple) molecule **M3** ionic bonds are stronger than intermolecular forces
2(b)(i)	$mol^{-2}\ dm^6$
2(b)(ii)	**M1** at equilibrium: moles of CO = 0.120 **AND** moles of H_2 = 0.240 **M2** $[CH_3OH]$ = 0.056 **AND** [CO] = 0.024 **AND** $[H_2]$ = 0.048 **M3** use of K_c with correct evaluation = 1.01×10^3
2(b)(iii)	no effect **AND** K_c is not affected by pressure
2(c)(i)	increases rate by providing a different mechanism with a lower activation energy
2(c)(ii)	$2CH_3OH \rightarrow CH_3OCH_3 + H_2O$
2(c)(iii)	$P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$