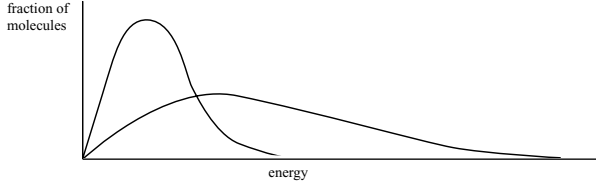


Answers to examination-style questions

| Answers | Marks | Examiner's tips |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1 (a) (i) graph starts at origin | 1 | You must remember to do all these things. This is worth 3 marks here. |
| graph skewed to left and has decreasing gradient to maximum | 1 | |
| graph after maximum decreases in steepness, never touches x -axis, levels out less than 5 mm from x -axis | 1 | |
| (b) minimum energy to start a reaction | 1 | Remember that the curve has a decreasing gradient on the left. It is not 'bell-shaped'. |
| (c) molecules gain energy when they collide with each other | 1 | |
| (d) decreases | 1 | |
| reaction goes by an alternative route which has a lower E_a (therefore more molecules have energy $>E_a$) | 1 | When two particles collide, one gains energy and the other loses energy. In this way particles pass on energy. |
| 2 (a) the minimum energy required for a reaction to occur | 1 | |
| (b) axes labelled: y : number (or fraction or %) of molecules; x : energy curve starts at origin skewed to right approaches x -axis as an asymptote | 1 1 1 1 | |
| second curve displaced to the left and peak higher many fewer molecules have $E > E_a$ | 1 1 1 | |
| (c) molecules do not have enough energy | 1 | |
| increase the pressure | 1 | The question talks about molecules so don't label the axis atoms! |
| increases the collision frequency | 1 | A curve that levels off $>10\%$ of max. peak height or a curve that crosses the energy axis will not score this last mark. |
| add a catalyst this lowers the activation energy | 1 1 | A curve that levels off $>10\%$ of max. peak height or a curve that crosses the energy axis will not score this last mark. |
| | | Curve must not cross T_1 curve twice. |
| | | This can also be shown on a correctly labelled diagram. |
| | | You could also say that the orientation may be wrong. |
| | | Alternatively you can refer to an increase in the concentration or a reduction in the volume. |
| | | This mark is not allowed if implied that more collisions come from a temperature increase. |

Answers to examination-style questions

| Answers | Marks | Examiner's tips |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------|
| 3 (a) minimum energy for a reaction to occur | 1 | You could say for a successful collision. |
| (b) few molecules / particles have the required activation energy | 1 | |
| (c) molecules are closer together | 1 | Because there are more particles in a given volume. |
| therefore they collide more often | 1 | |
| (d) many more molecules have energy greater than the activation energy | 1 | You need to explain in full what a catalyst is (2 marks) although there is only one mark available. |
| (e) speeds up a reaction but is chemically unchanged at the end | 1 | |
| (f) increases the surface area | 1 | |
| 4 (a) (i) Z | 1 | |
| (ii) collisions cause some molecules to slow down or lose energy | 1 | When particles collide they pass on energy which means some gain and some lose. If they lose energy they slow down. |
| (b) curve starts at origin and is displaced to the right curve lower and does not touch energy axis | 1 | |
| (c) (i) only a small percentage of collisions have $E > E_a$ | 1 | There are 2 things needed for each mark so practise drawing these curves. |
| (ii) add a catalyst lowers E_a | 1 | |
| more collisions (or molecules) have energy $> E_a$ | 1 | |
| 5 (a) | 2 | |
|  | | |
| (b) the curve should be higher and displaced to the left (see above) it should start at the origin and cross the other curve only once and not cross the x-axis | 1 | Or increase the pressure. |
| (c) particles have energy $< E_a$ | 1 | |
| (d) increase concentration | 1 | |

Answers to examination-style questions

| Answers | Marks | Examiner's tips |
|---------------------------------------------------|----------------------|---------------------------------------|
| (e) many more molecules have $E > E_a$ | 1 1 | You must not say KE increases with T. |
| (f) lowers E_a provides an alternative route | 1 1 | |