KINETICS PAPER 1A

1. C
2. C
3. C
4. B
5. C

6. B
7. B
8. C
9. D
10. A

11. B
12. B
13. C
14. B
15. B

16. A
17. B
18. A
19. B
20. C

KINETICS PAPER 1B

1. (a) $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$ [2] (1 for formulas, 1 for states).

   (b) Carbon dioxide gas escapes from the open flask into the surroundings [1].

   (c) (149.70 - 150.00) / 30 = -0.010 g s^{-1} [2] (1 value, 1 unit).

   (d) At 90 seconds (mass stops changing) [1]. The limiting reactant was fully consumed [1].

2. (a) Draw a tangent to the curve exactly at t=20s [1]. Calculate the gradient/slope of the tangent, which equals the instantaneous rate [1].

   (b) As the reaction proceeds, the concentration of the acid decreases [1]. This results in a decreased collision frequency between reacting particles, thus lowering the rate [1].

KINETICS PAPER 2

1. (a) T_2 is the higher temperature [1]. The peak is shifted to the right (higher average kinetic energy) and is lower/broader [1].

(b) At T_2, the area under the curve to the right of E_a is much larger [1], meaning a significantly greater proportion of particles have $E \geq E_a$, leading to more successful collisions [1].

(c) The catalyst shifts the E_a line to the left (provides a lower E_a pathway) [1]. This immediately places a greater proportion of particles above the new activation energy threshold, increasing successful collisions [1].

2. (a) Axes labeled correctly with units [1]. Appropriate linear scale used [1]. Smooth curve drawn through all points [1].

(b) A straight line touching the curve exactly at t = 20 s without crossing it (tangent) [1]. Correct mathematical working involving rise / run explicitly derived from the tangent line [1]. Instantaneous rate ≈ 1.4 $cm^3\ s^{-1}$ with correct units [1].

3. (a) The particles must collide with the correct stereochemical orientation/geometry [1].

4. (a) Absorbance is directly proportional to concentration (Beer-Lambert law) [1]. Create a calibration curve with known concentrations to convert absorbance readings to concentration values [1].

5. (a) 1. Collecting the O_2 gas and measuring its volume over time using a gas syringe [1]. 2. Measuring the loss of mass of the open flask over time on a balance as O_2 escapes [1].