

(Exothermic and endothermic reactions)

Q1. (2019)

sports injury pack

Q2. a) (2019)

D

Q2. b) (2019)

systematic error

Q2. c) (2019)

polystyrene cup

Q2. d) (2019)

all six points plotted correctly

line of best fit

**line extrapolated correctly to
y-axis**

Q2. e) (2019)

20.4 (°C)

Q2. f) (2019)

the mixture was not stirred

too little sulfuric acid was added

Q3.(2020)

water

Q4. (2020)

**temperature decreases (during
the reaction)**

Q5.a) (2020)

all six points plotted correctly

line of best fit

extrapolation to meet the printed
line

Q5.b) (2020)

$$22.6 - 20.2$$

$$= 2.4 (^{\circ}\text{C})$$

Q6.(2020)

temperature of solution

Q7. (2022)

Energy Change

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- **measure volume of (hydrochloric) acid**
- with a measuring cylinder
- pour (hydrochloric) **acid into a suitable container** eg polystyrene cup
- measure the initial temperature (of hydrochloric acid)
- with a thermometer
- **add a known mass of sodium carbonate**
- measured with a balance
- stir
- **measure the highest temperature reached**
- **repeat with different masses of sodium carbonate**
or
add successive masses of sodium carbonate to the same mixture
- repeat the whole investigation
- use the same starting temperature
- use the same volume of (hydrochloric) acid each time
- use the same concentration of (hydrochloric) acid each time

Q8.a) (2022)

change in highest temperature

corresponding change in mass

$$\frac{\text{(gradient =)} \\ \text{change in highest temperature}}{\text{change in mass}}$$

(gradient =) 1.6

°C/g

Q8.b) (2022)

extrapolates line to the y-axis

20.6 (°C)

alternative approach:

(highest temperature at 1.0 g –
change in highest temperature
per gram =)
22.2 – 1.6 (1)

= 20.6 (°C) (1)

Q8.c) (2022)

C

Q9.a) (2022)

(X) energy

Q9.b) (2022)

**(level of) products is below
(level of) reactants**

Q10.a)(2023)

(independent variable)
mass (of ammonium nitrate)

(dependent variable)
(lowest) temperature (reached
by solution)

Q10.b)(2023)

all 6 points plotted correctly

line of best fit

Q10.c)(2023)

line extrapolated to y -axis

(initial temperature)
value for temperature where
extrapolated line meets y -axis

Q10.d)(2023)

temperature decreased

Q10.e)(2023)

(0.3 °C) is the uncertainty

(because 0.3 °C) is the range
about the mean value

Q10.f)(2023)

random error

Q11.(2024)

volume of copper sulfate
solution

Q12.a)(2024)

line of best fit using the first five
points

line of best fit using the last four
points

Q12.b)(2024)

Energy Change

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energy is **taken in from** the
surroundings so the reaction is
endothermic