Level 2 Chemistry: practice paper 2026

AS 91166 Demonstrate understanding of chemical reactivity · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) A class reacts 2.0 g of marble (calcium carbonate, $CaCO_3$) with hydrochloric acid, and times how long it takes to collect 40 mL of carbon dioxide. Their results are in the table.
Write a balanced equation for the reaction, and state how each of the changes in experiments B, C and D affected the rate, compared with experiment A.

Experiment	Marble	HCl concentration (mol L^{-1})	Temperature (°C)	Time for 40 mL of CO_2 (s)
A	chips	1.0	20	96
B	powder	1.0	20	18
C	chips	2.0	20	45
D	chips	1.0	30	50

(b) Describe how a catalyst increases the rate of a reaction.

(c) Use collision theory to explain why experiments B and C were faster than experiment A.

(d) In experiment D, raising the temperature from 20 °C to 30 °C almost doubled the rate (96 s down to 50 s). A rise of 10 °C only makes the particles collide a few percent more often.
Discuss why the higher temperature increased the rate so much.

QUESTION TWO

(a) Hydrogen and iodine react in a sealed flask at 450 °C:
$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
Write the equilibrium constant expression, Kc, for this reaction.

(b) At equilibrium at 450 °C, $[H_2] = 0.0200$ mol L^{-1}, $[I_2] = 0.0200$ mol L^{-1} and $[HI] = 0.140$ mol L^{-1}. Calculate Kc, and state what its value tells you about the position of the equilibrium.

(c) Nitrogen dioxide (a brown gas) and dinitrogen tetroxide (a colourless gas) are in equilibrium in a sealed syringe:
$2NO_2(g) \rightleftharpoons N_2O_4(g)$ $\Delta rH = -57$ kJ mol^{-1}
The plunger is pushed in, increasing the pressure. Explain what happens to the position of the equilibrium and to the colour of the mixture.

(d) The same syringe is placed in hot water.
Discuss the effect on the position of the equilibrium, the colour of the mixture and the value of Kc.
Compare this with what would happen if a catalyst were added instead.

QUESTION THREE

(a) Calculate the pH of 0.0250 mol L^{-1} hydrochloric acid, HCl.

(b) A drain cleaner solution has a pH of 11.20.
Calculate $[H_3O^+]$ and $[OH^-]$ in the solution. Kw = 1.00×10^{-14}.

(c) A 0.100 mol L^{-1} solution of hydrochloric acid has a pH of 1.00, but a 0.100 mol L^{-1} solution of ethanoic acid, CH_3COOH, has a pH of 2.88.
Explain the difference, using equations.

(d) Sodium hydroxide, NaOH, and ammonia, NH_3, solutions both have a concentration of 0.0500 mol L^{-1}. Kw = 1.00×10^{-14}.

Calculate the pH of the sodium hydroxide solution. Then discuss how the pH and the electrical conductivity of the two solutions compare, using equations.

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