Practical Test

Skill P **16 marks, maximum**
(18 marking points available)

Titration method – 8 marks (max)

Controlled dilution of hydrogen peroxide using pipette and volumetric flask. [1]
This mark may also be awarded from the second experiment

Suitable dilution factor *(by 50 at least)* for hydrogen peroxide calculated. [1]
Calculation must be explained clearly

Suitable titrant selected, such as $KmnO_4$ of known concentration [1]
Doing an 'iodine' titration with 'known' sodium thiosulphate is suitable

Key titration conditions outlined [1]
*$KmnO_4$ used in burette **and** mixture acidified*
***or** use of excess acidified KI, with aq sodium thiosulphate in the burette*
***and** use of pipette to measure out H_2O_2*

End point procedure discussed correctly [1]
No indicator needed for $KmnO_4$: pale pink end colour
***or** use of starch, blue colour discharged at end-point*
***and** two consistent titres obtained*

Equation ***or*** both ionic half equations for titration reaction quoted [1]

Explanation of the redox chemistry involved in the titration reaction [1]
This should be related to the end-point colour change.

Specimen calculation of H_2O_2 concentration from titration data shown clearly [1]

Second method – 6 marks (max)

Chooses a suitable procedure,
such as catalytic decomposition of H_2O_2 with gas collection. [1]

Draws workable apparatus ***and*** uses suitable named catalyst/enzyme. [1]

Appropriate measurements:
known volume of H_2O_2 used ***and*** final volume of gas measured [1]

Accuracy precautions (*two needed, such as those below*)
Inner test tube (or other device) to keep chemicals apart until start of reaction
***and** readings repeated* [1]

Calculates a suitable quantity of H_2O_2 to use, allowing for the capacity of syringe. [1]

Shows clearly how the molar concentration of H_2O_2 is calculated from readings. [1]

Safety, Sources and QWC – 4 marks

Correct explanation ***or*** definition of '100 volume' researched. [1]

Relevant safety precaution when using concentrated H_2O_2 quoted. [1]

At least two secondary sources used with specific references quoted. [1]
*Chapter **or** page number for book(s) should be given*
***or** internet address(es) as far as first forward slash*

Good Quality of Written Communication
and within 400 – 800 word range. [1]

Practical Test (Part B)

Page 5 Skill I – 14 marks (+ Skill A – 2 marks)

Titration readings – 4 marks

Readings tabulated, with readings to 0.05 cm^3 and unit given. [1]
Two accurate titres are within 0.1 cm^3 [2]
*Allow **one** mark if both accurate titres are within 0.2 cm^3*
Mean titre **correctly** calculated and shown clearly on page 5 [1]

Accuracy of titration – 6 marks

Mean titre is within 1.2 cm^3 of supervisor's value. *(about 24 cm^3)* [1]
Mean titre is within 0.8 cm^3 of supervisor's value. [2]
Mean titre is within 0.6 cm^3 of supervisor's value. [3]
Mean titre is within 0.4 cm^3 of supervisor's value. [4]
Mean titre is within 0.3 cm^3 of supervisor's value. [5]
Mean titre is within 0.2 cm^3 of supervisor's value. [6]

Temperature measurement – 4 marks

Both initial and final temperatures recorded, with unit. [1]
Mean temperature rise correctly calculated with unit. [1]

Mean temperature rise is within 3°C of supervisor's result *(about 14°C)* [1]
Mean temperature rise is within 2°C of supervisor's result [2]

Safety – 2 marks

Suitable specific safety precaution stated [1]
Precaution explained related specifically to the materials used [1]

Pages 6 & 7 Skill A – 14 marks

The other 2 marks for Skill A are awarded on page 5.

*Most marking points are worth **two marks** each.*
One mark is awarded if the working is correct, but the answer calculated is wrong.
A correct answer will attract both marks.

(a) n(thiosukphate) used in mean titre = 0.08 x 0.024 = 0.00192 mol
Calculation example assumes a mean titre of 24 cm^3 [2]

n(iodine) produced in titration = 0.5 x 0.00192 = 0.00096 mol [1]

(b) n(H_2O_2, diluted) in 25 cm^3 = n(I_2) = 0.00096 mol [2]
The mole ratio must be explained from the equation given on the paper

(c) [H_2O_2] in solution **B** = 0.00096 x $^{250}/_{25}$ x $^{1000}/_{10}$ = 0.96 mol dm^{-3} [2]

(d)(i) Formula: 'heat produced = mass *x* shc *x* temperature rise' used [1]

Heat produced = 10 x 4.2 x 14 = 588 J *(assumes 14°C rise)* [2]

(ii) Enthalpy of decomposition = $-^{0.588}/_{0.0096}$ = -61.3 kJ mol^{-1}
(missing negative sign is not *penalised here)* [2]

Negative sign given for ΔH,
And appropriate sig. fig. for ***all*** *answers.* [2]

Skill E 14 marks, maximum

(a) Enthalpy – 10 marks (max)

*The best **four** groups of points made should be marked.*

Heat losses from test tube [1]
Use insulating material such as plastic (etc) for/around the reaction vessel. [1]
Put a lid on the apparatus [1]

Plot a cooling curve [1]
Sketch of a cooling curve [1]
Explanation of its interpretation [1]

Thermometer used is not very accurate. [1]
A thermometer reading to 0.1°C should be used. [1]
Reference to % accuracy in measuring relatively small temperature rise [1]

Temperature readings are reliable (*ora*)... [1]
...because both temperature rises were consistent (*ora*) [1]
Justification using actual values obtained [1]

Reaction kept fizzing after the maximum temperature had been measured. [1]
Therefore reaction had not finished [1]
Not all the heat had been released. [1]

Mass of catalyst used was not measured [1]
Greater mass of catalyst would lead to a more rapid evolution of energy. [1]
Weigh catalyst for fair comparison [1]

(b) Titration – 6 marks (max)

Titration equipment is accurately manufactured [1]
% accuracy tolerance of one piece of titration apparatus stated. [1]
Overall % error of titration discussed, resulting from apparatus tolerances. [1]

The end point colour change with starch is easy to see [1]
The change of colour of indicator is sharp and therefore accurate [1]

Titration data is **reliable** (*ora*)... [1]
...because of consistent repeated titres (*ora*) [1]

H_2O_2 was fizzing during the measurement with the pipette. [1]
Its concentration was thereby reduced slightly.
or amount of iodine produced would therefore be too small. [1]