4. This question is about bombardier beetles

(a) (i) $2H_2O_2 \rightarrow 2H_2O + O_2$ **1**

State symbols not required

(ii) Oxidation Reduction **Disproportionation** Hydrolysis Dehydration **1**

(b) Combining $2H_2O_2 \rightarrow 2H_2O + O_2$ and **A** + ½O_2 → **B** + H_2O gives **1**

H_2O_2 + **A** → **B** + $2H_2O$

(c) (i) Amount of energy = specific heat capacity ×temp. change ×mass of water

= 4.18 J g^{-1} K^{-1} × 80 K × 1000 g **1**

= 334 kJ

(ii) Conc. of H_2O_2 in mixed solution = energy needed per litre / enthalpy change per mole of H_2O_2

= 334 kJ dm^{-3}/ 203 kJ mol^{-1}

= 1.65 mol dm^{-3} **2**

Therefore with equal volumes mixed, conc. of H_2O_2 initially must be double this value = 3.30 mol dm^{-3}

*Award one mark for the value of 1.65 mol dm^{-3}, and one mark for the realisation of the need to double the concentration. Allow ECF from **(c)(i)**.*

(d) (i) 6 **1**

(ii) 3 **1**

(e) **Peak I** O–H **1**

Peak II C–H **1**

(f) (i) –OH *(or hydroxyl)* **1**

(ii) –CH_3 *(or methyl)* **1**

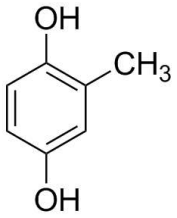
(g) H_1 V

H_2 VII

H_3 VI **2**

All correct: two marks, two correct: one mark, one correct: half a mark

(h)



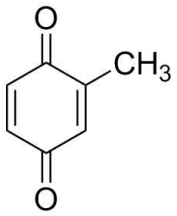
1

Compound **A**

1

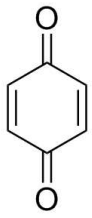
Compound **C**

(i)



1

Compound **B**



1

Compound **D**

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