

*The time limit for this test is 50 minutes.*

*Numerical answers must be given with appropriate units and significant figures. Please place all answers in the space provided for the question. IF more space is required write on the back of the question sheet and indicate this in the answer space.*

*There are seven questions worth a total of 39 marks. If more than one answer is given only the first answer will be graded unless you indicate otherwise.*

*Data tables are supplied separately. DO NOT WRITE ON THESE. Hand them in with your exam.*

***This examination should be written in non-erasable INK***

*Exams that have been altered by erasures or white out may be ineligible for appeal of grades at the discretion of the professors.*

Question 1	9 / 9
Question 2	2 / 3
Question 3	5 / 5
Question 4	3.5 / 6
Question 5	5 / 5
Question 6	6 / 6
Question 7	0 / 5
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TOTAL	30.5 / 39



2. Name the following compounds:

[6 marks]

a)  $\text{SiCl}_4$

Silicon Tetrachloride ✓

b)  $\text{H}_2\text{CO}_3$

dihydrogen carbonate ✓

c)  $\text{HNO}_2$

hydrogen nitrite ✗

$\text{HNO}_3$

↳ Nitrous Acid

~~nitric acid~~

2

3. A 28.4 g wafer of pure gold, initially at  $100.0^\circ\text{C}$ , is submerged into 64.2 g of water at  $24.8^\circ\text{C}$ , in an insulated container. What is the final temperature of both substances at thermal equilibrium? The specific heat capacity of gold is  $0.129 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ . [5 marks]

$$m = 28.4 \text{ g}$$

$$T_i = 100^\circ\text{C}$$

$$q_{\text{water}} = -q_{\text{gold}}$$

$$m\Delta T = -m\Delta T$$

$$(28.4 \text{ g})(0.129 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1})(T_f - 100.0^\circ\text{C}) = -(64.2 \text{ g})(4.184 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1})(T_f - 24.8^\circ\text{C})$$

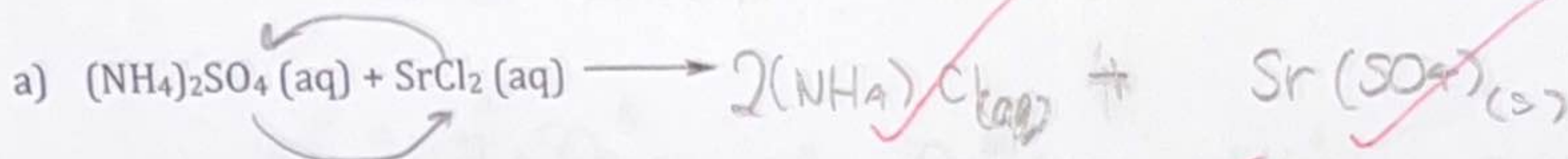
$$3.6636(T_f - 100.0) = -(268.6128)(T_f - 24.8)$$

$$3.6636T_f - 366.36 = -268.6128T_f + 6664.597$$

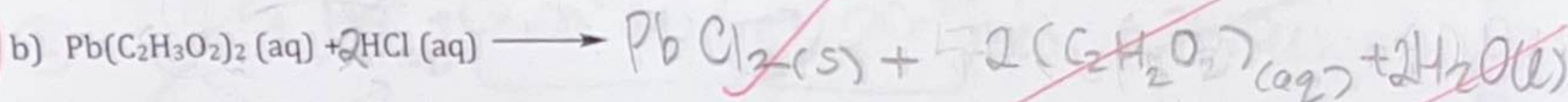
$$272.2764T_f = 7027.957$$

$$T_f = 25.81^\circ\text{C}$$

4. Identify the products of the following reaction and balance the equations. Clearly identify the type of each reaction. Use total ionic equations of products for clarity. Subsequent reactions may occur, if so, identify both. If no reaction, say so. [6 marks]



Precipitation Rxn



- 0.5 wrong product

- 2 second rxn.

Precipitation Rxn

5. A piece of dry ice (solid carbon dioxide) with a mass of 28.8 g sublimates (converts from solid to gas) into a large balloon. Assuming that all of the carbon dioxide ends up in the balloon, what is the volume of the balloon at a temperature of 22 °C and a pressure of 989 mbar? [5 marks]



$m = 28.8\text{g}$

$M = 44.01\text{g/mol}$

$P = 989\text{mBar} = 0.989\text{Bar}$

$T = 22^\circ\text{C} = 295\text{K}$

$PV = nRT$

$(0.989)(V) = (0.654\text{mol})(0.08314)(295)$

$V = 16.22\text{L}$

$V = 16.2\text{L}$

$V = 16\text{L}$

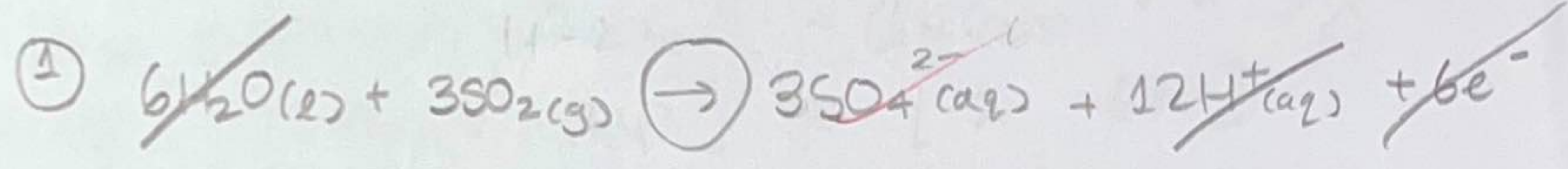
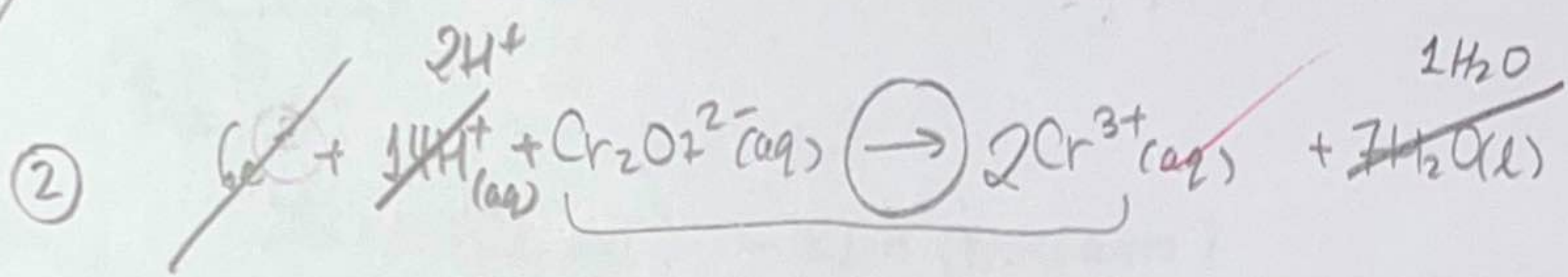
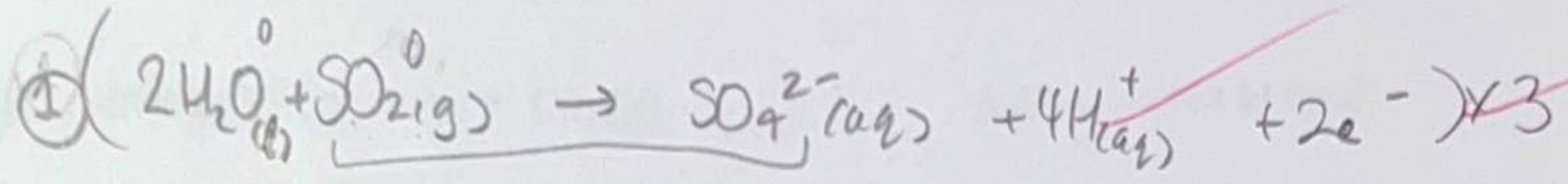
$n = \frac{m}{M}$

$n = \frac{28.8\text{g}}{44.01\text{g/mol}}$

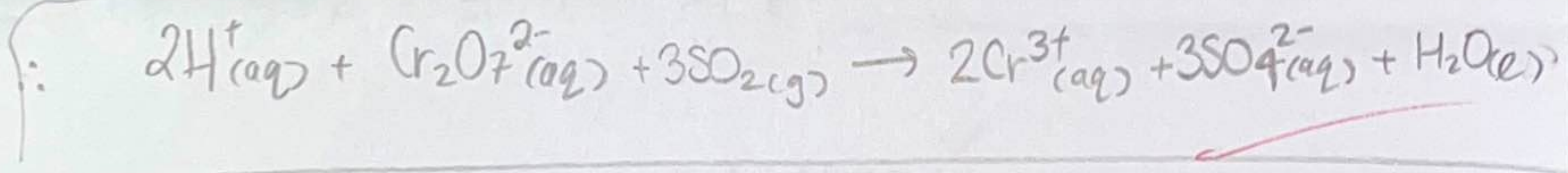
$n = 0.6543\text{mol}$

6. Balance the following redox reaction in acidic solution:

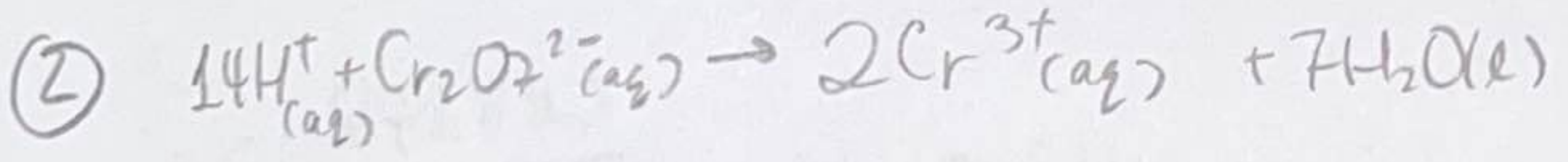
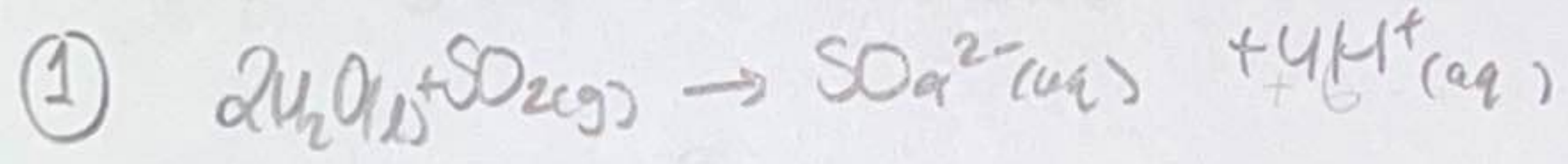
6 [6 marks]



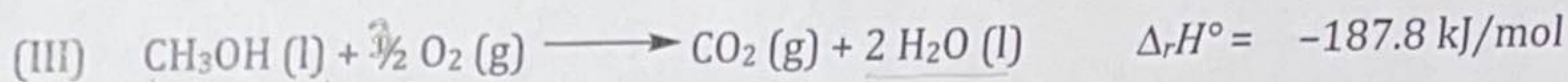
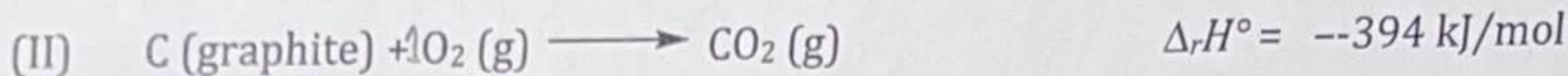
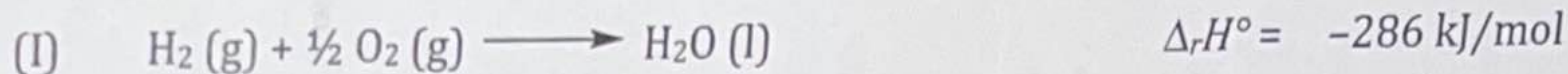
Final eqn:



work:



7. Use the following thermochemical equations to calculate the standard enthalpy change for the formation of methanol (CH<sub>3</sub>OH). [5 marks]



$\Delta H_{\text{CH}_3\text{OH}} = x ?$

$\Delta H_{\text{rxn}} = \sum \Delta H_f(\text{Products}) - \sum \Delta H_f(\text{Reactants})$

$\Delta H_{\text{rxn}} = (\Delta H_{\text{H}_2\text{O}(\text{l})} + \Delta H_{\text{CO}_2(\text{g})}) - (\Delta H_{\text{O}_2(\text{g})} + x)$  ~~X~~

$-187.8 \frac{\text{kJ}}{\text{mol}} = [2(-286) + (-394)] - [x - 680]$

$-187.8 = (-572 - 394 - x + \frac{3}{2}(680))$

$-187.8 = -572 - 394 - x + 1020$  ~~X~~

$-241.8 \frac{\text{kJ}}{\text{mol}} = -x$

~~X~~  $241.8 \frac{\text{kJ}}{\text{mol}} = x = \Delta H_{\text{CH}_3\text{OH}(\text{l})}$

Use Hess' Law