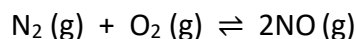


## EQUILIBRIUM AHL (HL only)

Please ensure that you have also completed the Core (SL & HL) questions

1. (a) Consider the equilibrium:



(i) Write an expression for the equilibrium constant,  $K_c$ , for the reaction.

[1]

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(ii) At a temperature,  $T$ ,  $K_c = 1.6 \times 10^{-3}$ . If the initial concentrations of  $\text{N}_2$  and  $\text{O}_2$  are each  $2.0 \text{ mol dm}^{-3}$  ( $0 \text{ mol dm}^{-3}$  of  $\text{NO}$  initially), calculate the concentration of  $\text{NO}$  at equilibrium.

[3]

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(iii) Using **section 1 and 2** of the data booklet, calculate the standard Gibb's free energy change,  $\Delta G^\ominus$ , for this reaction, in kJ, if temperature  $T = 1400^\circ\text{C}$ .

[3]

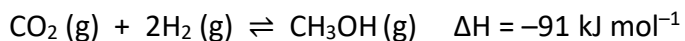
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(iv) State and explain what your answer to (iii) suggests about the position of equilibrium.

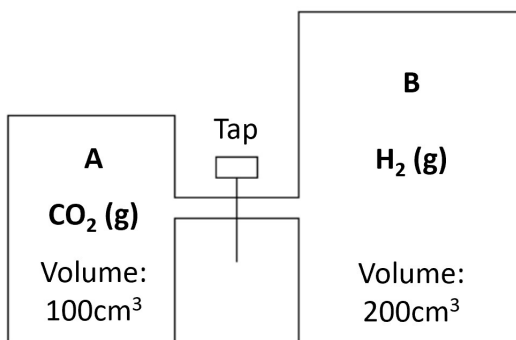
[1]

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2. An experiment is carried out to investigate the following equilibrium:



Chamber **A** contains 1.00 mol of  $\text{CO}_2(\text{g})$  and chamber **B** contains 2.00 mol of  $\text{H}_2(\text{g})$ .



(a) What **initial** pressure change will occur, if any, when the tap is opened.

[1]

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(b) Write an expression for, and calculate the theoretical value of  $K_c$ , if the maximum yield of  $\text{CH}_3\text{OH}$  in this experiment is 90%. Give your answer to 3 significant figures.

[5]

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(c) How will the initial pressure have changed when the experiment reaches equilibrium. Explain your reasoning.

[2]

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Total 16 marks (24 minutes)