SEPTEMBER 2008 MHS TRIAL NOVEMBER EXAM SOLUTIONS

Penalties : the usual ones! * max[m] 1 mark off if incorrect numbers of significant figures are given
* max[m] 1 mark off if symbols of state are omitted
* 1 mark off each time a unit is omitted from answer that requires a unit

SECTION A

Σ = 20

1. D	2. D	3. B	4. D	5. C	6. A	7. B	8. C	9. B	10. A
11. A	12. C	13. B	14. D	15. C	16. B	17. D	18. C	19. C	20. A

SECTION B

Σ = 63 marks * = one mark

1. (9 x 0.5 + 0.5 = 5marks)

a

change	Effect on mass of CO at equilibrium	Effect on mass of H_2 at equilibrium	Effect on mass of CH_3OH at equilibrium
More H_2 is added etc	decrease	increase	increase
The volume is incr etc	decrease	decrease	increase
The temp is increased etc	increase	increase	decrease

b. Line should sweep upwards (opposite to the existing line) so it finishes 2.5 units above starting point.

2 At t = 0, [A] = 3.5/0.500 = 7.0M*

At t = equilib, n(A) = 2.0 x 0.500 = 1.0 mol. ∴ 2.5 mol. reacted *∴ n(B formed) = 2.5mol. n(C formed) = 1.25 mol*

∴[B] = 2.5/0.500 = 5M . ∴[C] = 1.25/0.500 = 2.5M*

$K = \frac{[B]^2[C]}{[A]^2} = 15.6M \quad (1.6 \times 10^1 M)$ *

3 a. $\frac{[C_6H_5COO^-][H^+]}{[C_6H_5COOH]} = 6.3 \times 10^{-5}$ mol L^{-1} *

$[H^+]^2 = 6.3 \times 10^{-5} \times 0.1$ *∴ $[H^+] = 2.5 \times 10^{-3}$ ∴ pH = 2.6*

b. % ionization = $\frac{[C_6H_5COO^-]}{[C_6H_5COOH]} \times 100$ * = $\frac{2.5 \times 10^{-3} \times 100}{0.10} = 2.5\%$*

4 ai. $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$ * aii. $2SO_{2(g)} + O_{2(g)} \rightleftarrows 2SO_{3(g)}$ * (must have equilib arrows)

b. Lower temp, higher pressure, add reactants, remove product

ci. vanadium (v) oxide *

cii increases the rate of the reaction *

ciii reactants passed through several trays of porous, loosely packed pellets ie increase surface area or passing reactants over a number of times. *

di $H_2SO_{4(l)} + SO_{3(g)} \rightarrow H_2S_2O_{7(l)}$ * dii $2H_2S_2O_{7(l)} + H_2O_{(l)} \rightarrow 2H_2SO_{4(l)}$ *

e. any reaction showing the oxidation of a reactant with sulphuric acid eg a metal becoming a metal ion and S or H reduced etc*

f. i. Can burn skin,eyes etc * ii. *

5 a) These are coal, oil, and natural gas and are essentially non renewable. They contain mainly carbon and hydrogen atoms and the energy is released when they are oxidized to carbon dioxide and water. *

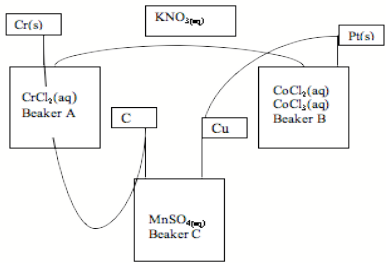
b) Advantages: High energy content per gram of fuel; suitable for small scale or large scale generation.*

Disadvantages: Produce greenhouse gases and other pollutants; supplies running out.*

c) Nuclear energy-> heat energy-> kinetic energy -> mechanical energy-> electrical energy.**

6 a)

* for correct ½ cells, * for electron flow Cu to Pt and Cr to C and * for correct connections including with salt bridge



b) Beaker A: $Cr(s) \rightarrow Cr^{2+}(aq) + 2e^-$ *

Beaker B: $Co^{3+}(aq) + e^- \rightarrow Co^{2+}(aq)$ *

Beaker C: $2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ carbon rod *

$Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$ copper rod *

7. a) ΔT=63.9 - 42.3 =21.6 °C. Energy loss = 4.18 x 50.0 x 21.6 = 4514J *

ΔT=21.2 – 42.3 = -21.1 °C. Energy gain = 4.18 x 50.0 x 21.1 = 4410J *

ΔE = 4514-4410 =104 J *

b) E=VIt =5.50 x 2.50 x 60.0 = 825 J ΔT = 0.529 °C *

C.F = 825/0.529 = 1560J $°C^{-1}$ *

(ii) ΔT = 22.726 – 19.106 = 3.62 °C *E = 1.526 x 3.62 = 5.65kJ, *M(sucrose) =342 $gmol^{-1}$

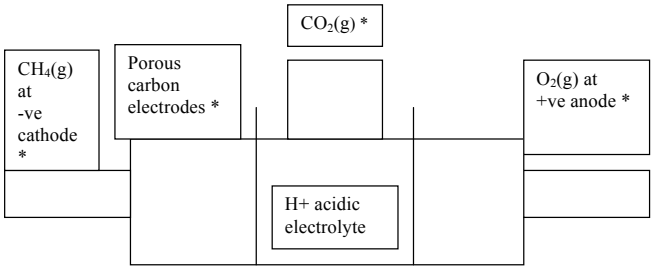
ΔH = 5.65 x 342/0.346 = -5.58 $x10^3$ kJ mol^{-1} *

(iii) Incomplete combustion of sucrose, sample not dry, experimental error in measuring the mass or temperature. *

(iv) Activation energy *

(v) The energy is needed to initiate the breaking of chemical bonds in the reaction. *

8.



b) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ *

c) At the anode: $(CH_4(g) + 2H_2O(l) \rightarrow CO_2(g) + 8H^+(aq) + 8e^-)$ *

At the cathode: $(O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l))$ *

d) The fuel cell transforms the chemical energy directly to electrical energy * and thus has a much higher efficiency than the corresponding combustion process where other types of energy are produced. *

9 a) At the anode:

$H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+ + 4e^-$ (due to 0.25M chloride solutions) *

At the cathode:

$Cu^{2+} + 2e^- \rightarrow Cu(s)$ *

b) **At the cathode:**

$2e^- + 2H_2O(l) \rightarrow H_2(g) + 2OH^-(aq)$ *

10. i) $\{10^3/2x(57x12 + 110x1 + 6x16)\}$ * x75520 = 42427kJ.*

ii) 114 mole of $CO_2(g)$ produces 75520Kj*

x mole of $CO_2(g)$ produces 2 x 2420kJ *

vol of $CO_2(g)$ in L at SLC = {2x2420/75520}x114x24.5 = 179L*

End of Answer