PREPARATORY PROBLEMS

AND

WORKED SOLUTIONS

ERRATA

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PROBLEM 8. (Solution)

In part f) the equation for the self-dissociation of propanol is unbalanced and should of course be:

$$\underline{2}\ C_3H_7OH \rightarrow C_3H_7O^- + C_3H_7OH_2^+$$

PROBLEM 9. (Solution)

Part c) should read:

c). If all $Li_{(s)}$ were converted to $Li_{2(g)}$, then there would be <u>19.117</u> moles $Li_{2(g)}$ in a volume of 5.9474×10^8 litres, corresponding to $[Li_{2(g)}] = 3.2143 \times 10^{-8}$ mol L^{-1}, or a total pressure of 1.2233×10^{-3} Torr.

PROBLEM 10. (Solution)

The 9th line of part d) should read:

Mass of $\mathbf{Y}^{i-}$ = mass ($\mathbf{X}$) – <u>molar</u> mass (H^+) × moles (OH^-)

PROBLEM 13.

The amount of sample should be 0.50 g (not 5.00 g) so the second paragraph should begin:

She weighs out 0.50 ± 0.01 g of each sample ...

The solution should then read:

b). Analysis of results:

moles M^+ in 0.5 g = moles OH^- × (250 mL / 50 mL) × (100 mL / 40 mL)
= titre volume × 0.0326 mol L^{-1} × 5 × 2.5

$M_r(MX)$ = sample mass (0.5 g) / moles M^+ in 0.5 g

The values in the table for possible molecular masses of the unknowns are unchanged.

PROBLEM 18. (Solution)

a). If we denote the initial activity as I_0 (i.e. 7.0×10^7 Bq mL^{-1} in each case), and I_t as the activity after a time t has elapsed, then I_t is defined as $I_t = I_0\, e^{-(t / t_{1/2})}$.

This equation is incorrect and the sentence should read:

a). If we denote the initial activity as I_0 (i.e. 7.0×10^7 Bq mL^{-1} in each case), and I_t as the activity after a time t has elapsed, then I_t is defined as $I_t = I_0\, e^{-(\ln 2\, t / t_{1/2})}$ or $I_t = I_0\, 2^{-(t / t_{1/2})}$

Using the correct equation, the table of nuclide activities is as follows:

nuclide	I_t (Bq mL^{-1})	I_t after dilution (Bq mL^{-1})
^{71}Zn	12100	4.83
^{67}Ga	6.97×10^7	2.79×10^4
^{68}Ge	6.9996×10^7	2.80×10^4

Using the correct equation, the answers to part d) are also changedslightly to:

In the 1 mL dose at t = 8 hr,

$I_t = I_0\, 2^{-(t / t_{1/2})} \times V_{dose} / V_{total} = 1.09 \times 10^8 \text{ Bq} \times 2^{-(8/78.25)} \times 1/100$

$I_t = 1.015 \times 10^6$ Bq.

ii). The residual activity of the 1 mL dose after a further hour would be

$I_t = 1.015 \times 10^6 \text{ Bq} \times 2^{-(1/78.25)} = 1.006 \times 10^6$ Bq.

Comparison of this activity, with that observed for the 1 mL blood sample, yields the dilution factor:

Dilution factor = $1.006 \times 10^6 / 105.6 = 9531$.

The patient's blood volume is thus 9.53 litres.

PROBLEM 20 (Solution).

The current solution to part a) assumes STP, but NO_2 is a liquid at a 0°C! However, because we are only *estimating* an upper limit for the concentration of NO_2, let's asume 25°C. The calculation then becomes:

$[NO_2]$ = 0.21 (mole % of O_2) / 24.484 L mol^{-1} (molar volume at 25°C)

= 8.6×10^{-3} mol L^{-1}

PROBLEM 21.

c). [You should assume that the total metal ion concentration is much less than 0.05 mol L^{-1}.]

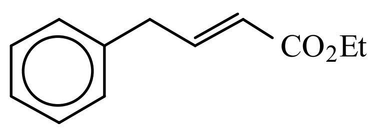
should be

[You should assume that the total metal ion concentration is much less than 0.005 mol L^{-1}.]

The answers are unchanged.

PROBLEM 26 (Solution).

The correct structure for the Wittig product (xxi) is an ethyl ester (not a methyl ester):



PROBLEM 29.

The equation for the reaction of iodine and thiosulphate is unbalanced and should of course be:

$I_2 + 2\ S_2O_3^{2-} \rightarrow 2\ I^- + S_4O_6^{2-}$

PROBLEM 30.

In the section: **Analysis for oxalate and iron** the equation for the reaction of tris(oxalato)ferrate(III) and acidified permanganate is unbalanced and should of course be:

$5\ Fe(C_2O_4)_3^{3-} + 6\ MnO_4^- + 48\ H^+ \rightarrow 5\ Fe^{3+} + 6\ Mn^{2+} + 30\ CO_2 + 24\ H_2O$

Also, the equation for the oxidation of iron(III) by permanganate incorrectly has Fe^{3+} as a reactant and of course should be:

$5\ Fe^{2+} + MnO_4^- + 8\ H^+ \rightarrow 5\ Fe^{3+} + Mn^{2+} + 4\ H_2O$