**Test – A2 Kinetics (Ans)**

**1.** (a) (1, 4-) buta(ne)dioic acid **(1)**

NOT dibutanoic acid, butane dicarboxylic acid, or ethane dicarboxylic acid  
Penalise wrong numbers

1

(b) Kc =  **(1)**

if Kc expression wrong lose units mark in (e) also  
must be [ ]

1

(c) *Moles of* ***X***: 0.25 - 0.13 = 0.12 **(1)***Moles of methanol*: 0.34 - 0.26 = 0.08 **(1)***Moles of water*: 0.26 **(1)**

(d) Equal no. of moles on each side of equation **(1)**

OR V cancels out (provided not incorrectly qualified)

1

(e) *Calculation*: Kc =  **(1)**  **=** 11(.4) **(1)**

Can score all 3 conseq on (b) and (c)  
If different values from (c) used allow units only (conseq on correct Kc)

*Units of K*c: none **(1)**

but lose this mark if Kc is wrong even if none given

3

(f) decrease **(1)** 1

[10]

**2.** (a) (i) *Number of moles of O2 at equilibrium:*  = 0.22 **(1)**

*Number of moles of NO at equilibrium:* 0.44 **(1)**

OR 2 × mol of oxygen

(ii) *Original number of moles of NO2:*  = 0.46(3) **(1)**

*Number of moles of NO2 at equilibrium:* 0.46(3) – 0.44 = 0.02(3) **(1)**

OR conseq on mol NO above

4

(b) *Expression for KC*: KC =  **(1)***Calculation:* KC =  = 7.0(0) mol dm–3  
 **(1) (1) (1)**

If mol NO2 = 0.02; KC = 9.26 (9.3)  
or conseq on values from (a)  
If vol missed, score only KC and units  
If KC wrong: max 2 for correct use of vol and conseq units  
If KC wrong and no vol: max 1 for conseq units

4

(c) pV = nRT **(1)**T =  = 

(1) for using 11.5 × 10–3 as V

T = 669 K **(1)** 3

(d) *Yield of oxygen:* increased **(1)**  
*Value of K*c*:* no effect **(1)** 2

[13]

**3.** (a) (i) moles of C2F2 = 0.40 mark independently from HC1 1  
moles of HC1 = 0.80 **not** consequential 1

(ii) 

wrong Kc means they can only 1  
 score for units in (iii) consequ  
 on their Kc

(iii)  1

= 0.35 1  
mol dm–3 1

(b) (i) increase 1

(ii) decrease 1

[8]

**4.** (a) (i) C + 3D 2A + B 1

(ii) mol dm–3 1

(iii) (forward reaction is) exothermic or more products formed 1

(b) (i) for N2O4 Mr = 92.0 1

Mol =  1

(ii) mol N2O4 reacted = 0.400 – 0.180 = 0.220 1

mol NO2 formed = 0.440 1

(iii) Kc = (NO2)2 1

(N2O4)

= (0.44/16)2 1

(0.18/16)

= 0.067 1

(iv) move to NO2/ to right / forwards 1

none 1

[12]

**5.** (a) (i) Moles NaOH = mv/1000 = 1.50 × 72.5/1000 = 0.108 to 0.11 **(1)**  
Moles of ethanoic acid at equilibrium = moles sodium hydroxide **(1)**  
Moles ester = moles water (=moles acid reacted) **(1)**  
 = 0.200 – 0.108 = 0.090 to 0.92 **(1)**Moles ethanol = 0.110 – 0.091 = 0.018 to 0.020 **(1)**  
*K*C = [Ester] [Water]/[Acid] [Alcohol] **(1)**

Allow if used correctly

= (0.091)2/0.109 × 0.019 = 3.7 to 4.9 **(1)** 7

Ignore units

NB Allow the answer 4 one mark as correct knowledge

(ii) Similar (types) of bond broken and made **(1)**  
Same number of the bonds broken and made **(1)** 2

any number if equal

NB If a list given then the total number of each type of bond broken and made must be the same

(b) (i) (Weak) dipole-dipole attraction between HCl **(1)**  
(Strong) **hydrogen bonds** between CH3COOH molecules **(1)** 2

NB Ignore van der Waals forces

(ii) Ethanoic anhydride is

cheap compared to etheanoyl chloride **(1)**

less corrosive than ethanoyl chloride or HCl evolved **(1)**

reaction less violent or vigorous or exothermic or dangerous  
or safer to use **(1)**

less vulnerable to hydrolysis **(1)**

reaction more easily controlled **(1)** Max 2

A = 45

B = 39

C = 34

D = 28

E = 22