Gateways School

**Kinetics & Equilibria**

**Revision PPQ Answers**

50 marks

**Q1.**

(a)     (i)      2

**1**

(ii)     0

**1**

(b)    (i)      *K* = 

*Correct answer for k with or without working scores 2.*

*First mark is for insertion of numbers into a correctly rearranged rate equ , k = etc.*

**1**

  = 5.05      (range allowed 5.03−5.07)

*AE (−1) for copying numbers wrongly or swapping two numbers.*

**1**

mol−2 dm+6 s−1

*Mark units separately, ie only these units but can be in any order.*

**1**

(ii)     8.3 × 10−6 (mol dm−3 s−1)

*Allow 0.83 × 10−5.*

*Ignore units.*

**OR** if not 8.3 × 10−6, look at their *k* in part(i) and if not 5.05

Allow ecf for their (incorrect) *k* × (1.64 × 10−6)

**1**

**[6]**

**Q2.**

(a)     (i)      Increase (if wrong no further marks in part (i)

**1**

higher *P* gives lower yield or moves to left

**1**

Eqm shifts to reduce *P* or eqm favours side with fewer moles

**1**

(ii)     Endothermic if wrong no further marks in part (ii)

**1**

increase *T* increases yield or moves to right

**1**

Eqm shifts to reduce *T* or eqm favours endothermic direction

**1**

(b)     (i)      Moles of iodine  =  0.023

*If wrong no marks in (i)*

**1**

Moles of HI        = 0.172

**1**

*If × 2 missed, max 1 in part (iv)*

(ii)     *K*c = 

*must be square brackets (penalise once in paper)
 – if round, penalise but mark on in (iv)*

*if Kc wrong, no marks in (iv) either but mark on from a minor slip in formula*

**1**

(iii)     V cancels in *K*c expression

*or no moles same on top and bottom of expression*

*or total moles reactants = moles products,
i.e. total no of moles does not change*

**1**

(iv)    *K*c  = 

*Conseq on (i)*

**1**

= 0.0179 or 1.79 × 10–2

*Allow 0.018 or 1.8 × 10–2*

**1**

(v)     *K*c = 55.9or 56

*Conseq i.e. (answer to (iv))–1*

**1**

**[13]**

 **Q3.**

(a)     Sensible scales

*Plotted points (including 0,0) must cover more than half the graph paper.*

*If axis wrong way round lose this mark but mark on consequentially.*

*Do not allow broken axis.*

**1**

Plots points correctly

**1**

(b)     Ring around the origin

**1**

(c)     Line through points is smooth

*Line must pass within ± 1 small square of each plotted point except the anomaly (allow one plot ± 2 small square – at 40 or 60s).*

**1**

Line through points is best fit and ignores anomaly (allow one plot ± 2 small square)

*Lose this mark if student’s line is doubled.*

*Kinked line loses this mark.*

*Lose this mark if the line does not pass through the origin + / – 1 small square.*

*Lose this mark if the line deviates to anomaly.*

**1**

(d)     Draws suitable tangent

*Must touch the curve at 30s and must not cross the curve.*

*Lose this mark if the tangent is unsuitable but mark on.*

**1**

Chooses appropriate *x* and *y* values from their graph

*Mark consequentially if axes plotted the wrong way around.*

*Allow information clearly shown on graph.*

**1**

Correctly calculates *y* / *x*

*Difference in x values and y values must be at least 10 small squares in either direction.*

**1**

Gives answer with correct units (mol dm–3 s–1) or correct variant

*Lose this mark if answer not to minimum of 2 significant figures and no units or incorrect units are given.*

*If student has used axis the wrong way round, the unit mark can be awarded for either the correct unit based on their graph or for the correct unit for rate.*

**1**

**[9]**

**Q4.**

(a)     = (0.0745) × (0.0813) / (0.0424) × (0.0525)

= 2.72

*Allow answer only without working if correct.*

*Lose this mark if the wrong Kc expression is used.*

**1**

Answer, whether or not correct, given to three significant figs

*Do not expect conversion from moles to concentration but allow if shown.*

**1**

(b)     Less acid is present (so less NaOH needed)

**1**

Equilibrium would shift to right (side with more ester / less acid)

**1**

**[4]**

**Q5.**

(a)     *(must state correct effect on yield or rate to score the reason mark)*

T       effect:  higher temp:    yield greater or shifts equilibrium to right;

**1**

effect:   higher temp:   rate increased;

**1**

reason:  endothermic

OR

more particles have E>Ea

**1**

OR

more successful/productive collisions;

**1**

P       effect:   higher pressure: yield less or shifts equilibrium to left;

**1**

         effect:   higher pressure: rate increased;

reason: increase in gas moles L to R

OR

greater collision frequency;

*(Q of L mark)*

**1**

(b)     M1     equilibrium moles of CO = 62.8 - 26.2 = 36.6

**1**

M2     equilibrium moles of H2 = 146 – 2(26.2) = 93.6

**1**

M3     total no moles = 36.6 + 93.3 + 26.2 = 156.4

**1**

M4     partial pressure = mole fraction x total pressure

**1**

M5            

**1**

M6    

         

         

**1**

M7     0.022(1)        2.2(l)×10–8 2.2(l)×10–14

**1**

M8        MPa–2 kPa–2 Pa–2

**1**

*If no subtraction lose M1, M2 and M3)
(If ×2 missed in M2, lose both M2 and M3)
(If M1 gained but moles of H*2 *= 73.2 (i.e. double CO), M2 and M3 lost)
(If M1 gained but mol H*2 *= 2(146 – 26.2), M2 and M3 lost)
(If M1 and M2 correct but M3 lost for CE, penalise M6 also)
(M4 can be gained from the numbers in the expression for M6 even if these numbers are wrong)
(If Kp contains [ ] lose M5 but then mark on)
(If chemically wrong expression for Kp, lose M5, M6 and M7 (allow M8 conseq on their K*p*))
(If divided by 9.5, or not used 9.5 at all, lose M6 and M7 (and M4))
(If tried to convert to kPa and is factor(s) of 10 out, penalise in M6 and allow M8 for kPa*–2*)*

**[14]**

**Q6.**

D

**[1]**

**Q7.**

D

**[1]**

**Q8.**

A

**[1]**