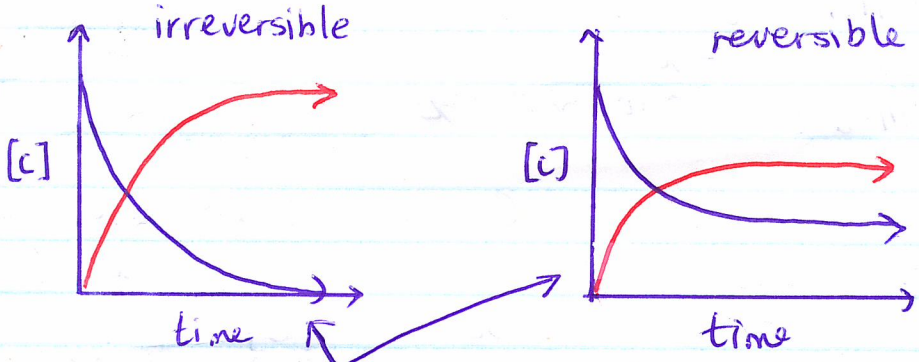
Equilibrium Practice Test

1. a reversible reaction has reached the point where the forward & reverse reactions have equal rates and the contents of the system are constant

2.



does not reach equilibrium
reaction ends when reactants are depleted

reaches equilibrium
reaction continues as long as no changes are made to the system
concentrations are constant

3. open systems are affected by matter in the surroundings, so it is more difficult (impossible?) for system to be constant
e.g. if a gas is produced, it can escape from the system and not react in the reverse process.

4. (a) left (c) left (e) $Q = \frac{[C]}{[B]^2} = 56$
(b) left (d) no change
$Q > K_{eq}$, reaction shifts left

5. 4 min – temperature changes (increase), shift right
10 min – remove CO, shift right
14 min – pressure decrease, shift right

6. (a) $K_{eq} = \dfrac{[Z]}{[X]^2[Y]}$

(b)

	$2X$	+ Y	$\rightleftharpoons$	Z
I	0.111	0.325		0
C	$-2x$	$-x$		$+x$
E	$0.111-2x$	$0.325-x$		x

7.

	$2A$	+ $3B$	$\rightleftharpoons$	C
I	0.214	0.89		0
C	$-2x$	$-3x$		$+x$
E	0.1105	$0.89-3x$		x

$0.214 - 2x = 0.1105$

$x = 0.0518$

$[B] = 0.735\ M$

$[C] = 0.0518\ M$

$$K_{eq} = \frac{[C]}{[A]^2[B]^3} = \frac{0.0518}{(0.1105)^2(0.735)^3}$$

$$= 10.7$$

8.

	X	+ $2Y$	$\rightleftharpoons$	Z
I	0	~~(s)~~		0.650
C	$+x$			$-x$
E	x			$0.65-x$

$$K_{eq} = \frac{[Z]}{[X]}$$

$$1.20 = \frac{0.65-x}{x}$$

$$2.20x = 0.65$$

$$x = 0.295$$

$[X] = 0.295\ M$

$[Y] = 0.355\ M$

9. $$Q = \frac{[N_2][H_2]^3}{[NH_3]^2} = \frac{(1.24)(0.179)^3}{(2.78)^2} = 0.000928$$

$K_{eq} < Q$, so left

	$2NH_3$	$\rightleftharpoons$ N_2 +	$3H_2$
I	2.78	1.24	0.179
C	$+2x$	$-x$	$-3x$
E	$2.78+2x$	$1.24-x$	$0.179-3x$