Question 1:

<u>Union:</u>

X → Y (Initial)

{X} → {X, Y} (Augmentation using X → Y with the inclusion of X)

{X, Y} → {Z, Y} (Augmentation using X → Z with the inclusion of Y)

X → {Y, Z} (Transitivity based on what we have just shown)

<u>Decomposition:</u>

X → {Y, Z} (Initial)

{Y, Z} → Y (Reflexivity)   {Y, Z} → Z (Reflexivity)

X → Y (Transitivity)   X → Z (Transitivity)

<u>Pseudo-Transitivity:</u>

X → Y (Initial)

{X, Z} → {Y, Z} (Augmentation of X → Y and Z)

{Y, Z} → A (Given FD)

Question 2: Possible FDs are coloured in green

A	B	C	D	E
1	X	1	M	1
2	Y	1	M	1
3	Y	4	N	3
4	W	2	L	5
5	W	2	M	1
6	T	5	O	2

a) A → B
b) B → A
c) A → C
d) B → C
e) C → D
f) C → E
g) D → E
h) {A, B} → C
i) {B, C} → E
j) {B, C, D} → E

Question 3:

A	B	C	D	E
1	2	1	6	2
1	2	1	4	3
2	4	2	7	4
3	2	1	4	3

Question 4:

a) Candidate key(s): {A, B}, {A, D}
b) Candidate key(s): {B, C}, {C, D}, A, E
c) Candidate key(s): C, {A, B}, D
d) Candidate key(s): {A, B}
e) Candidate key(s): {A, D}, H, J

Question 5:

a) Insert anything into B, C, D and E without also inserting a value into A
b) Deleting the tuple with B = 4 as we lose information for the functional dependency (B → {D, E}), specifically (4 → {3, 2})
c) Updating {2, 2, 1, 5, 6} to {2, 3, 1, 5, 6} creates the inconsistency of (B → {D, E}), creates the inconsistency (3 → {5, 6}) and (3 → {5, 4})