1. A reversible reaction is one that:

   ☐ can go both forwards and backwards

   ☐ gives off no energy

   ☐ never reaches equilibrium

   ☐ only goes forwards

2. Le Chatelier's principle says that a change to a system at equilibrium causes it to:

   ☐ explode

   ☐ stop reacting

   ☐ shift to oppose (reduce) that change

   ☐ shift to increase that change

3. Guldberg and Waage proposed the law of mass action in 1864.

   ☐ True ☐ False

4. The Haber process makes:

   ☐ sulfur trioxide, from sulfur dioxide

   ☐ sulfuric acid, from sulfur trioxide

   ☐ oxygen, from liquid air

   ☐ ammonia, from nitrogen and hydrogen

5. In the Brønsted–Lowry theory, an acid is a:

   ☐ electron acceptor

   ☐ proton donor

   ☐ proton acceptor

   ☐ electron donor

6. A strong acid is one that is:

   ☐ only partly dissociated

   ☐ always dilute

   ☐ very concentrated

   ☐ fully dissociated into ions in water

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   ☐ True ☐ False

8. A closed system is needed to reach equilibrium.

   ☐ True ☐ False

9. Increasing the pressure shifts equilibrium towards the side with more gas molecules.

   ☐ True ☐ False

10. A mixture has 2.0 mol N_2 and 6.0 mol H_2 at 400 kPa. What is the partial pressure of N_2 in kPa?

    _____

1. **can go both forwards and backwards**

   A reversible reaction (⇌) can form products and turn them back into reactants.

2. **shift to oppose (reduce) that change**

   The equilibrium position always moves in the direction that lessens the change you made.

3. **True**

   Christiania, now Oslo.

4. **ammonia, from nitrogen and hydrogen**

   The Haber process makes ammonia: $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (exothermic).

5. **proton donor**

   A Brønsted–Lowry acid donates a proton (H^+); a base accepts one.

6. **fully dissociated into ions in water**

   A strong acid splits up almost completely into ions; a weak acid only partly dissociates.

7. **True**

   It changes colour at neutralisation.

8. **True**

   If the system were open, products could escape and the forward and reverse rates could never balance.

9. **False**

   False. By Le Chatelier's principle, higher pressure shifts equilibrium towards the side with fewer gas molecules, which reduces the pressure.

10. **100**

    x = 0.25; 0.25 × 400.

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