MCQs — Homogeneous Catalysts (with Answers)

1. **In homogeneous catalysis, the catalyst and reactants are in:**

   a) Different phases

   b) The same phase

   c) Any phase necessarily

   d) Only solid phase

   Answer: b — in homogeneous catalysis, catalyst and reactants are in the same phase (usually liquid or gas).

2. **Which of the following is an example of a homogeneous catalyst?**

   a) Platinum on alumina

   b) Enzyme such as carbonic anhydrase

   c) Iron in Haber's process

   d) V_2O_5 in contact process

   Answer: b — enzymes operate in solution as homogeneous catalysts.

3. **Which of the following acts as a homogeneous catalyst in organic hydrogenation reactions?**

   a) Raney nickel

   b) Wilkinson's catalyst ($RhCl(PPh_3)_3$)

   c) Activated charcoal

   d) Platinum

   Answer: b — Wilkinson's catalyst is a well-known homogeneous hydrogenation catalyst (a rhodium complex).

4. **A proton (H^+) in aqueous solution often acts as a homogeneous catalyst because:**

   a) It changes phase

b) It reacts with products

c) It is in the same phase as reactants

d) It forms a complex surface

Answer: c — protons in solution act as homogeneous catalysts with reactants in the same liquid phase.

5. **Which statement about homogeneous catalysts is correct?**

   a) They must be solids

   b) They remain unchanged at the end of reaction

   c) They always form a surface layer

   d) They never form complexes with reactants

   Answer: b — catalysts are not consumed and are regenerated after the reaction.

6. **Which of the following reactions is an example of homogeneous catalysis?**

   a) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ with NO(g) as catalyst

   b) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ on Pt(s)

   c) NH_3 synthesis on iron surface

   d) Hydrogenation on Pd/C

   Answer: a — when all species are in the same gaseous phase, it's homogeneous catalysis.

7. **Which is a typical characteristic of homogeneous catalysts?**

   a) They act through adsorption on solid surfaces

   b) They are in a phase different from reactants

   c) They accelerate reactions by forming intermediates in solution

   d) They always require high temperatures

   Answer: c — homogeneous catalysts often form soluble intermediates with reactants.

8. **Grubbs' catalyst used in olefin metathesis reactions is an example of:**

   a) Heterogeneous catalyst

   b) Homogeneous catalyst

   c) Enzyme catalyst

   d) Surface catalyst

   Answer: b — Grubbs' catalysts are organometallic homogeneous catalysts used in solution.

9. **Which of the following is *not* typically a homogeneous catalyst?**

   a) Transition metal complex in solution

   b) Mineral acids in ester hydrolysis

   c) Pt supported on alumina

   d) Ionic acid in sugar hydrolysis

   Answer: c — supported platinum is heterogeneous.

10. **Homogeneous catalysis usually offers:**

    a) Low selectivity

    b) High selectivity and milder conditions

    c) Only gas phase reactions

    d) Only enzyme catalysis

    Answer: b — homogeneous catalysts can be highly selective and operate under mild conditions.