1. Oxidising methylbenzene with hot alkaline $KMnO_4$ gives:

   ☐ cyclohexane

   ☐ benzoic acid

   ☐ nitrobenzene

   ☐ phenol

2. An ester can be made at room temperature by reacting an acyl chloride with:

   ☐ water only

   ☐ an amine

   ☐ an alkane

   ☐ an alcohol or a phenol

3. An acyl chloride reacting with ammonia gives:

   ☐ an amide (plus HCl)

   ☐ an alkene

   ☐ an ester

   ☐ a carboxylic acid

4. Which carboxylic acid can be oxidised further?

   ☐ benzoic acid

   ☐ propanoic acid

   ☐ ethanoic acid

   ☐ methanoic acid (HCOOH)

5. Reacting phenol with benzoyl chloride gives:

   ☐ ethyl ethanoate

   ☐ phenol again

   ☐ phenyl benzoate

   ☐ benzoic acid

6. Acyl chlorides react vigorously with water to give a carboxylic acid and _____ chloride gas.

   _____

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   ☐ True ☐ False

8. Making an ester from an acyl chloride happens at room temperature.

   ☐ True ☐ False

9. Phenol fizzes with sodium carbonate solution, like ethanoic acid does.

   ☐ True ☐ False

10. An ester is hydrolysed by hot aqueous alkali in a reaction called _____.

    _____

1. **benzoic acid**

   The whole side-chain is oxidised to a –COOH group, giving benzoic acid.

2. **an alcohol or a phenol**

   Both alcohols and phenols react with acyl chlorides to give esters (+ HCl).

3. **an amide (plus HCl)**

   Ammonia (or a 1°/2° amine) reacts with an acyl chloride to give an amide.

4. **methanoic acid (HCOOH)**

   Methanoic and ethanedioic acids can be oxidised further (e.g. to CO_2); most carboxylic acids cannot.

5. **phenyl benzoate**

   A phenol + an acyl (benzoyl) chloride forms the ester phenyl benzoate.

6. **hydrogen**

   Misty fumes of HCl form.

7. **True**

   A test for the acid group.

8. **True**

   Acyl chlorides are very reactive, so the reaction proceeds quickly at room temperature.

9. **False**

   Phenol is too weak an acid to release CO_2 from a carbonate; only carboxylic acids do this.

10. **saponification**

    It gives a carboxylate salt and an alcohol.

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