Unit 17 · Organometallic Compounds

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

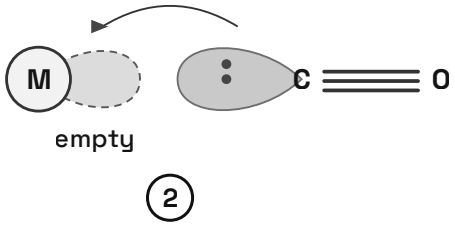
back-bonding	**carbanion**	**ether**	**ferrocene**	**Gilman reagent**	**Grignard reagent**
ketones	**organometallic**	**transmetallation**	**Zeise's salt**		

A compound with at least one direct bond between a metal atom and a carbon atom is called an _____ compound. An alkylmagnesium halide, RMgX, is called a _____, and it is made in dry _____. A lithium dialkylcuprate, R_2CuLi, is called a _____. Passing an organic group from one metal to another is called _____. In a metal carbonyl the metal gives electrons from a filled d orbital into an empty π^* orbital of CO: this is called _____. Dialkylcadmiums turn acid chlorides into _____ and stop there. $K[PtCl_3(C_2H_4)]\cdot H_2O$, made in 1830, is called _____.

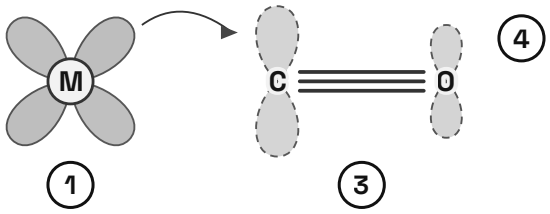
2 Label the diagram [2]

The diagram shows the two parts of the bond between a d-block metal and carbon monoxide. Write what belongs in place of 1 to 4. Each carries 0.5 mark.

(a) σ donation: C → M



(b) π back-bonding: M → CO π*



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. Which of these is an organometallic compound? [1]

a. CH_3CH_2ONa **b.** $(CH_3)_2Cd$

c. CH_3COONa **d.** CH_3CH_2OMgBr

ii. In which compound is the carbon attached to the metal the most strongly $\delta-$? [1]

a. $(CH_3)_2Cd$ **b.** CH_3MgBr

c. CH_3Li **d.** $(CH_3)_2CuLi$

iii. Ethylmagnesium bromide with propanone, followed by acid hydrolysis, gives: [1]

a. butan-2-ol **b.** pentan-2-one

c. 2-methylbutan-2-ol **d.** propanoic acid

iv. A Grignard reagent with carbon dioxide, then acid, gives: [1]

a. an aldehyde

b. a ketone

c. a carboxylic acid with one more carbon atom

d. an alkane

v. In Zeise's salt, the ethene molecule is bonded to platinum: [1]

a. through one carbon atom, in the plane of the $PtCl_3$ group

b. side-on, with its C=C at right angles to the $PtCl_3$ plane

c. through a hydrogen atom

d. by an ionic bond

4 Short answers [11]

Write short answers to the following questions.

a. Why must a Grignard reagent be made and used in dry ether? Give two reasons. [2]

b. Write balanced equations for the preparation of i. ethyllithium from chloroethane, and ii. dimethylcadmium from methylmagnesium bromide. [2]

c. Which Grignard reagent and which carbonyl compound would you use to make propan-2-ol, $CH_3CH(OH)CH_3$? Write the equation. **[2]**

d. Give two differences between the reactions of a Grignard reagent with HCN and with a nitrile, RCN. **[2]**

e. Why does a chemist use a dialkylcadmium, not a Grignard reagent, to make a ketone from an acid chloride? Write the equation for dimethylcadmium with ethanoyl chloride. **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

Starting from methylmagnesium bromide, how would you prepare i. ethanol, ii. ethanoic acid, iii. 2-methylpropan-2-ol and iv. methane? Write an equation for each.

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https://science-playground.com/learn/grade-12-chemistry/organometallic-compounds

6 Numerical problems [8]

Solve the following problems. Show your working. Take H = 1, C = 12, O = 16, Br = 80, I = 127, and the molar volume of a gas at STP as 22.4 L.

a. 2.84 g of iodomethane is turned completely into methylmagnesium iodide. i. Write the equation. ii. How many moles of Grignard reagent are formed? iii. The reagent is poured into water: what volume of methane is given off at STP? iv. The same amount of reagent is instead used up exactly by 1.48 g of a monohydric alcohol, ROH, and gives the same volume of methane. Find the alcohol's molar mass and its formula. [4]

Answer:

b. In a Corey–House synthesis, 4.36 g of bromoethane reacts completely with lithium dimethylcuprate. i. Write the equation. ii. Name the alkane formed. iii. Find its mass and its volume at STP. iv. Why couldn't the Wurtz reaction of bromoethane and bromomethane with sodium make this alkane cleanly? [4]

Answer:

7 Think [3]

Ethyl methanoate, $HCOOC_2H_5$, with excess methylmagnesium bromide gives a secondary alcohol, but methyl ethanoate, CH_3COOCH_3, gives a tertiary one. Explain why, naming both alcohols.

8 Activity: Read the label

(not marked)

Find a strip or bottle of vitamin tablets at home or in a pharmacy, and read the ingredients.

Product	Form of vitamin B_{12} named	Group bonded to cobalt through carbon

Is vitamin B_{12} an organometallic compound? How can you tell from its name?