Unit 12 · Ethers

WORKSHEET

Full marks 36

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 36

1 Key words [3]

Write True or False in the box beside each sentence. Correct each false sentence. Each carries 0.5 mark.

i. Ethoxyethane and butan-1-ol are functional isomers. ☐

ii. Ethoxyethane boils far higher than pentane because ether molecules hydrogen-bond to each other. ☐

iii. 2-Chloro-2-methylpropane and sodium methoxide give 2-methoxy-2-methylpropane. ☐

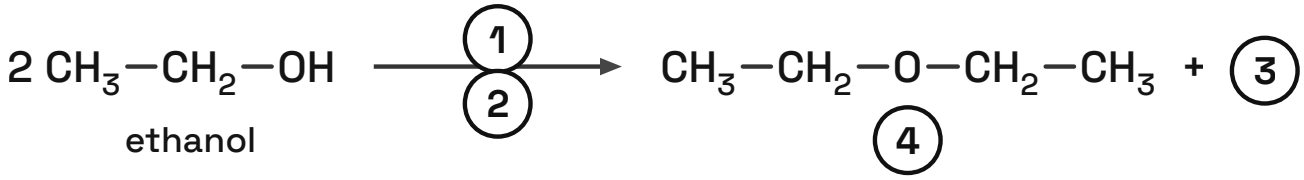
iv. Ether forms the upper layer when shaken with water in a separating funnel. ☐

v. Anisole and HI give iodobenzene and methanol. ☐

vi. Ethers dissolve in cold concentrated sulphuric acid by forming oxonium salts. ☐

2 Label the diagram [2]

The diagram shows how ethoxyethane is made from ethanol. Write what belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The IUPAC name of $CH_3–O–CH_2CH_2CH_3$ is: [1]

a. propoxymethane **b.** 1-methoxypropane

c. methyl propyl ether **d.** butan-1-ol

ii. At 443 K, instead of 413 K, ethanol and concentrated sulphuric acid give mostly: [1]

a. ethoxyethane **b.** ethene

c. ethanal **d.** diethyl sulphate

iii. 2-Methoxy-2-methylpropane, $(CH_3)_3C–O–CH_3$, is heated with one mole of HI. The products are: [1]

a. iodomethane and 2-methylpropan-2-ol **b.** 2-iodo-2-methylpropane and methanol

c. 2-methylpropene and methanol **d.** iodomethane and 2-iodo-2-methylpropane

iv. Old ether that turns a mixture of iron(II) sulphate and potassium thiocyanate red contains: **[1]**

a. water **b.** ethanol

c. peroxides **d.** iodine

v. Anisole is nitrated mainly at the: **[1]**

a. meta position, because $-OCH_3$ withdraws electrons

b. para position, because $-OCH_3$ pushes electrons into the ring

c. oxygen atom

d. methyl group

4 Short answers **[11]**

Write short answers to the following questions.

a. Write balanced equations for Williamson's synthesis of i. methoxyethane and ii. anisole. **[2]**

b. Why can't anisole be made from chlorobenzene and sodium methoxide? **[2]**

c. Why is ethoxyethane a good solvent for Grignard reagents and reactions with sodium? **[2]**

d. Write the equations for the action of hot HI on ethoxyethane i. with one mole of HI, and ii. with excess HI. **[2]**

e. Why do ether bottles become dangerous when kept open for a long time? How are peroxides tested for, and how are they prevented? **[3]**

5 Long answer [4]

Write a long answer to the following question.

What is Williamson's synthesis? Explain why it needs a primary haloalkane, and show how you would make 2-methoxy-2-methylpropane, $(CH_3)_3C–O–CH_3$, by it. What happens if the reactants are chosen the other way round?

6 Numerical problems [8]

Solve the following problems. Show your working. Take H = 1, C = 12, O = 16, Na = 23, I = 127.

a. 7.10 g of iodomethane is heated with excess sodium propan-2-oxide (sodium isopropoxide), $(CH_3)_2CHONa$. i. Write the equation and name the ether. ii. Find the mass of ether formed at 100% yield and at 75% yield. iii. Name the products when this ether is heated with one mole of HI, and give a reason. [4]

Answer:

b. 46.0 g of ethanol is heated with concentrated sulphuric acid at 413 K. i. Write the equation. ii. Find the mass of ethoxyethane formed if all the ethanol reacts. iii. The yield is 80%: find the mass and the volume of ether (density 0.71 g/cm^3). iv. About 6 g of ether dissolves in 100 mL of water. How much ether is lost if the product is washed with 50 mL of water? [4]

Answer:

7 Think [3]

Why can't ethoxyethane and methoxypropane be made pure by heating a mixture of ethanol and propan-1-ol with concentrated sulphuric acid? Which ethers would form, and how would you make methoxypropane instead?

8 Activity: Two layers (not marked)

Do this with water and cooking oil, not ether: ether's vapor catches fire easily. In a clear bottle, shake 50 mL of water with 20 mL of cooking oil and a few drops of food coloring, and let it stand.

	Top layer	Bottom layer	Where the color goes
water and oil			

Ether (0.71 g/cm^3) would behave like the oil. How would a chemist use a separating funnel to take an organic compound out of water with ether?