Unit 20 · Paper and Pulp

WORKSHEET

Full marks 37

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

1 Key words [4]

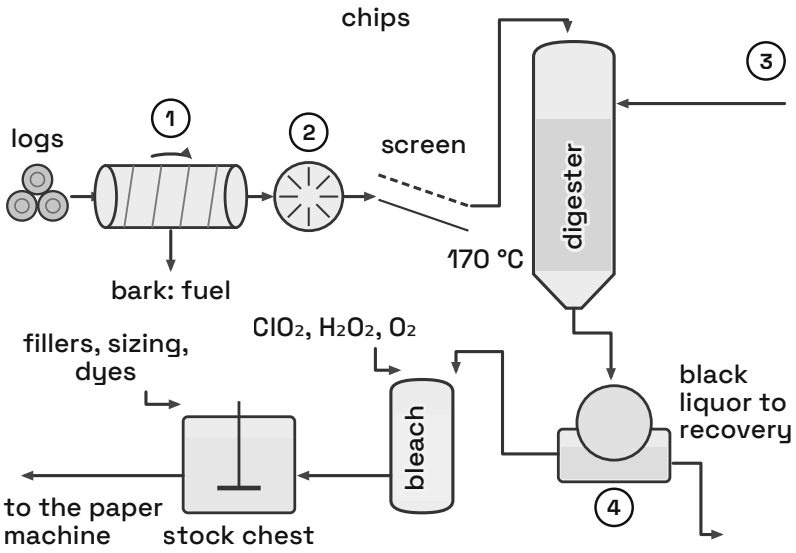
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

bast	**calender**	**cellulose**	**digester**	**fillers**	**GSM**	**hemicellulose**	**lignin**	**pulp**
sizing								

Paper is a mat of plant fibers made mostly of _____, held together by hydrogen bonds between their –OH groups. In wood the fibers are glued together by _____, which yellows paper. The soft mass of separated fibers from which paper is formed is _____. Fibers from the inner bark of a plant, such as lokta and jute, are _____ fibers. In the kraft process the chips are cooked under pressure in a _____. Rosin and alum are used for _____, which stops ink from spreading. Kaolin and calcium carbonate are added as _____, and the weight of a paper is given as its _____, grams per square meter.

2 Label the diagram [2]

The diagram shows a kraft pulp mill. Write the part or substance that 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. Long fibers that give paper its strength come from: [1]

a. softwood such as pine
b. hardwood such as eucalyptus
c. straw of wheat and rice
d. recycled paper

ii. Mechanical pulp gives a yield of about 90–95% but chemical pulp only about 45–50% because chemical pulping: [1]

a. cuts the fibers short
b. dissolves the lignin and much of the hemicellulose
c. burns part of the wood
d. adds water to the fibers

iii. White office paper glows blue under an ultraviolet lamp because it contains: [1]

a. titanium dioxide
b. alum
c. optical brightening agents
d. starch

iv. Books printed between about 1850 and 1990 often turn brown and crumble because: [1]

a. their fibers were too long
b. the alum used in sizing is acidic and slowly breaks the cellulose chains
c. they were bleached with hydrogen peroxide
d. they contain too much calcium carbonate

v. Which paper would you choose for a birth certificate that must last for generations? [1]

a. newsprint, 45 GSM
b. tissue paper
c. glossy coated magazine paper
d. lokta paper

4 Short answers [11]

Write short answers to the following questions.

a. Why does a sheet of dried paper hold together without any glue, and why does it fall apart when soaked? [2]

b. Name the three substances a plant fiber's wall is made of, and say which one chemical pulping removes and why. [2]

c. Give two reasons why bagasse and bamboo are called sustainable sources of paper. **[2]**

d. A newspaper left in sunlight turns yellow within days, but the pages of a good book don't. Explain. **[2]**

e. Describe what happens to the pulp on a Fourdrinier paper machine, from the headbox to the reel. **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

Compare mechanical and chemical (kraft) pulping under four headings: how the fibers are freed, chemicals used, yield, and the paper made. What is done with the black liquor in a kraft mill?

6 Numerical problems [8]

Solve the following problems. Show your working. GSM is the mass of paper in grams per square meter.

a. The 100 sheets of paper in a notebook, each 20.0 cm × 25.0 cm, have a mass of 350 g. i. Find the paper's GSM. ii. Into which grade does it fall, and what is it used for? iii. An A4 sheet is 1/16 of a square meter. Find the mass of one A4 sheet of a 250 GSM file cover. [4]

Answer: _____

b. A mill pulps 12.0 tonnes of pine chips (dry mass) by the kraft process, with a yield of 48%. i. What mass of pulp does it get? ii. What mass would mechanical pulping give from the same chips, at a yield of 93%? iii. The kraft pulp is made into 80 GSM A4 paper, each sheet of mass 5.0 g, with fillers making up 10% of the paper's mass. How many sheets is that? [4]

Answer: _____

7 Think [3]

Each time paper is recycled its fibers get a little shorter. Explain why recycled paper can't be recycled for ever, and why a mill making recycled paper often mixes in some fresh softwood pulp.

8 Activity: Five papers

(not marked)

Collect five kinds of paper: a piece of newspaper, a notebook page, a tissue, a page of a glossy magazine and, if you can, a piece of lokta paper. Tear each and look at the torn edge with a hand lens. Put one drop of water on each, and leave a strip of each in the sun for a week.

Paper	Fibers at the torn edge (long or short)	The drop of water (soaks in, spreads or stays)	After a week in the sun
newspaper			
notebook page			
tissue			
magazine page			
lokta paper			

Which paper is sized, and which keeps its lignin? How can you tell?