

# AGRICULTURAL TECHNOLOGY

## GRADE 12

### MATERIALS AND STRUCTURES

### TOOLS, EQUIPMENT, IMPLEMENTS & MECHANISED SYSTEMS

# CHAPTER 1

## MATERIALS AND STRUCTURES

### ADHESIVES

1. Name the two most important aspects, which must be considered when an adhesive is chosen?

- a) Type of material to be joined.
- b) Conditions under which this joint will be used.

2. Name some types of adhesives.

- a) Epoxy.
- b) Silicon.
- c) Resorcinol.
- d) Latex.
- e) PVA/PVC

3. Name the conditions under which an adhesive could be used and describe each shortly.

a) **Heat resistance** (Temperature)

The adhesive itself should not distort, melt or burn when heated. Some kinds of plastic are extremely heat resistant like **Bucalite**, and some are not heat resistant like **Perspex**, which easily changes shape when heated.

b) **Water-resistance**

When placed in humid conditions, a water resistant adhesive should be used to make a joint.

c) **Elasticity**

Some adhesives get very hard and brittle when they dry. If we want to join elastic materials, we would use an adhesive, which would still be elastic after it has become dry. E.g.. Bostic, Prestic.

d) **Load capacity**

The adhesive should be able to withstand mass or tension.

e) **Inflammability**

If an adhesive is to be used to join synthetic materials where it is subjected to open flames or heat the adhesive itself must comply with the same properties.

f) **Duration of cohesion.**

The period of time that an adhesive will stick after having been applied.

g) **Duration of usability**

Period of time during which the mixed adhesive remains usable before setting. The catalyst and accelerator can have a influence on the speed at which this happens.

4. **Describe the difference between cohesion and adhesion.**

**Cohesion**

Inherent strength of the adhesive.

**Adhesion**

Ability of the molecules of an adhesive to cling to the molecules of other substances.

5. **What can you recommend to improve the cohesion properties of an adhesive?**

Apply a thin base coat if the surface is very porous.

Apply only a thin layer of adhesive.

Apply adhesive to both surfaces.

Too thick layer of adhesive will result in a weak joint.

## **METALWORK**

1. **What is the reason/objective of giving metals a heat treatment?**

- a) To increase the degree of hardness and strength.
- b) To increase elasticity.
- c) To soften metals for the working processes to follow.
- d) To eliminate internal tension caused by machining.

2. **Describe what is meant with annealing?**

Refers to one of the heat treatment processes which has been developed to soften hardened steel so that it can readily be put through further processes of reshaping.

3. **Name the three phases of the annealing process.**

- a) Heating to an acceptable temper temperature.
- b) Working through for a sufficient period at a chosen temperature.
- c) Cooling at a controlled temperature.

4. **Name the factors that have an influence on the heat treatment of metals.**

- a) Carbon. (Greatest influence of all)
- b) Tempo of cooling.

5. **Describe the following:**

a) **End maximum temperature**

Highest temperature 720°C to which a piece of steel can be heated to effect efficient hardening by fast cooling.

b) **End minimum temperature**

The lowest temperature 695°C to which a piece of steel can be heated and still be hardened efficiently.

c) **Tempering**

The process by means of which a tool is cooled in order to affect certain hardness.

d) **Matrix**

Base metal.

e) **Critical point**

Little or no hardening will take place if the metal is not heated to a temperature between 695°C and 720°C.

f) **Malleability**

The ability of metal to become transformed without breaking.

g) **Slip**

Refers to atom disruption, fragmentation or mat-disruption of metal when it is reshaped by cold working. Can only be removed by heat treatment.

6. Explain how rapid cooling and slow cooling affect the hardness of the base metal.

**Rapid cooling:**

- carbides are not given the opportunity to become separated from the matrix again
- in which case the steel will be rich in carbon and alloy elements
- and will be very hard.

**Slow cooling:**

- carbides will be able to become separated from the matrix
- coming out of solution and the matrix become poor in carbon and alloy elements and therefore softer.

7. **How can cracks be prevented during the fast cooling process?**

Cool steel in oil and not in water.

8. **Describe the hot working of steel, and provide the advantages and disadvantages.**

a) **Describe the hot working of steel.**

- a) A steel rod has no economical value if it is not transformed into a useful form.
- b) Hot working is the reshaping of a hot steel rod into structural shapes e.g. bars, plating.
- c) Hammering, pressing or rolling reshapes the steel that is in a plastic state.
- d) Reshaping of iron is done at a temperature of 450°C.

**b) Name the advantages of hot working.**

- a) Porosity is greatly eliminated.
- b) Impurities in the form of inclusions are broken up.
- c) Physical properties are improved.
- d) Amount of energy needed to bring the steel to its new form is much less than cold working.

**c) Name the disadvantages of hot working.**

- a) Enormous oxidation takes place that forms scale on the metal surface..
- b) No fine tolerances can be acquired due to scale on the surface.
- c) The thickness of the metal increases when heated.

**9. Describe the Cold working of steel.**

- a) Metal is worked at a temperature lower than the recrystallizing temperature.
- b) Most metals are cold worked at room temperature.
- c) Reshapes metal by rolling, drawing or stretching it.

**10. Name the advantages of cold working.**

- a) Finer dimensional tolerances can be retained.
- b) A smooth surface finishes because oxidation does not occur.
- c) Strength and hardness of the metal are increased.
- d) Process is cheap.
- e) Greater number of parts can be manufactured more quickly.

**11. Name the disadvantages of cold working.**

- a) A tension that can only be removed afterwards by heat treatment develops within the metal.
- b) Distortion of the grain develops.
- c) Higher pressure and heavier equipment are used.
- d) Overworking result in the metal becoming brittle, and it is necessary to soften it once more.

**12. Name the influences that the following alloy elements have on stainless steel.**

**Chromium**

- a) Increases resistance against corrosion.
- b) Promotes the hardening of steel.
- c) Improves strength.
- d) Improves resistance to the formation of scale.
- e) Improves tensile strength.
- f) Decreases magnetism.
- g) Most chromium steels can be welded well.

**Manganese**

- a) It combats corrosion.
- b) Gives steel a coarser structure.
- c) Changes the band structure, at the same time causing a reduction in striking strength.
- d) Increases tensile strength.
- e) Reduces the critical cooling tempo and by doing so improves hardening.
- f) Increases resistance against wear.
- g) Reduces magnetism.

**Nickel**

- a) It improves the amount of toughness and the hardening ability.
- b) One of nickel's greatest advantages is that it gives steel a fair amount of toughness at low temperatures.
- c) Used with chromium, nickel helps to increase the hardening ability of steel much more than when only one of the elements is used.
- d) Steel which is alloyed with chromium and nickel is resistant to air, water and many chemical acids and alkali.

**13. Compare the qualities of stainless steel and mild steel in table form.**

Qualities	Stainless steel	Mild steel
Weldability	Very good, if the correct welding rods are used	Very good
Shapeability (malleability and forgeability)	Reshapes with difficulty even at very high temperatures	Very good (malleable and forgeable)
Corrosion resistance	Very good	Poor (rusts easily)
Durability	Very durable (does not easily bend or fracture)	Poor (bends easily and wears quickly)
Cost and economic considerations	Relatively expensive to manufacture, but lasts so much longer and has so many good qualities that it is still preferred to mild steel for certain jobs.	Cheaper to manufacture but because of its low corrosion resistance and low resistance to wear uneconomical in certain cases so stainless steel is preferred as it is more economical in the long run.

## CHAPTER 2

### FARM IMPLEMENTS

#### BAILING PRESSES

1. **Name the two types of baling machines.**

- a) Ram or piston type makes oblong rectangular bales.
- b) Roller type makes cylindrical bales.

2. **Describe the working of the ram type of baler.**

- a) The baler is driven from a power **take-off**.
- b) When the **flywheel** rotates, the crankshaft also rotates causing the ram to move backwards and forwards.
- c) At the same time the **packing arms** move in and out of the baling chamber and the auger continuously rotates.
- d) The **pick-up wheel**, which is a spring, teeth pick up the hay as the baler moves foreword and puts it onto the combine plates where it comes into contact with the feeding auger.
- e) The **auger**, that is floating, constantly rotates and feeds the hay to the packing arms.
- f) The **packing arms** that move up and down to the hay feed the hay to the baling chamber, where it comes into contact with the ram.
- g) The hay is compressed in the baling chamber by the **ram** with a forward backward movement. This movement is synchronized with the packer arms. It allows hay to be fed into the baling chamber by the packing arms when it is withdrawn to its maximum.
- h) The baler is fitted with a **blade** on the side of the ram in order to separate the hay in the baling chamber from the rest.
- i) Two **needles** are used to push the ropes through the bale where the knotting mechanism catches it and binds it.
- j) **Measuring wheel** that slowly rotates as the bale moves through the baling chamber measures the bale and activates the needles and knotting mechanism as soon as the desired bale length is acquired.

3. **How is bale density changed in the ram type baler?**

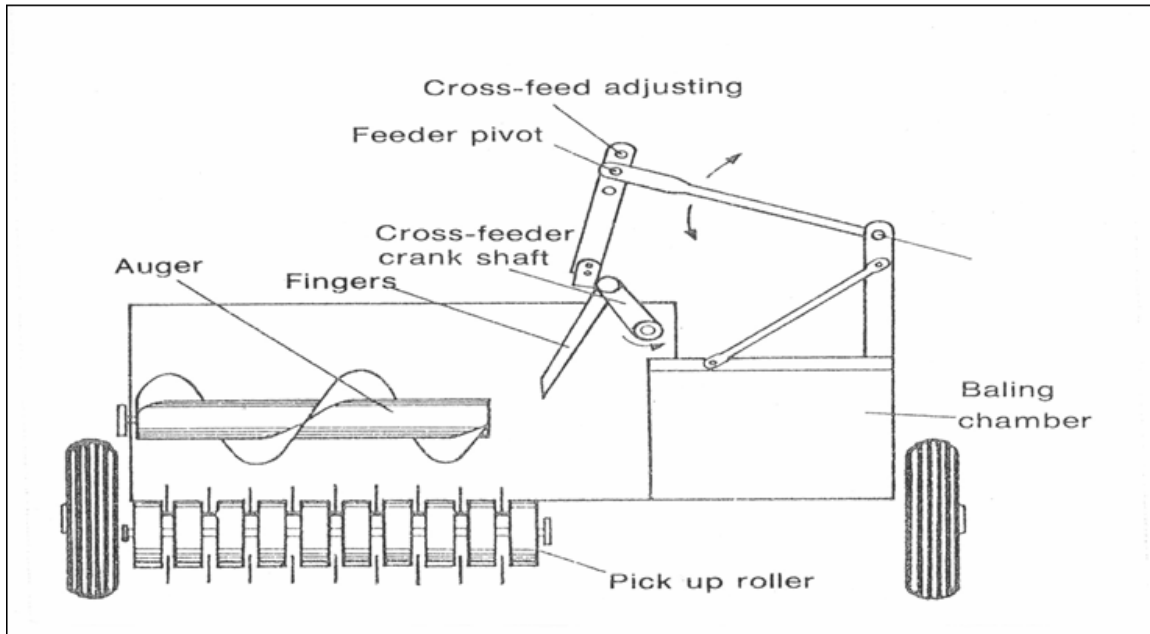
By increasing or decreasing the resistance to the hay moving through the baling chamber.



4. **What is the function of the slip clutch? (Ratchet plate)**

- a) Prevent heavy objects from being taken into the baler.
- b) Protect the pick-up if it is impeded by anything.
- c) Protect the auger if it becomes overloaded.

5. **The position of the packer arms**



6. A top view of the layout of the main working parts of the pick-up baler.

