GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

REMOTE LEARNING ACTIVITY BOOK

(RELAB)

SUBJECT: FITTING & MACHINING

GRADE: 11

LEARNER WORKBOOK

GGT2030
GROWING GAUTENG TOGETHER

INTRODUCTION AND PURPOSE OF THE RELAB

The Covid 19 pandemic has caused serious impact to schooling resulting in major learning loss and instructional time. This scenario has resulted in school implementing rotational timetables-where learners attend school on alternate days or weeks. The Remote Learning Activity Book was conceptualized to engage learners in constructive learning on days they are at home. Hence the RELAB was developed as a strategy to enhance remote learning.

The RELAB is underpinned by the following Legislative demands:

a) Responding to GDE Strategic goal 2 promoting quality education across all classrooms and schools
b) **DBE Circular S13 of 2020** the requires the GDE to support the implementation of the Recovery Annual Teaching Plan (RATP)
c) **GDE Circular 11 of 2020** requiring districts to issue Learning Activity Packs to support schools for lockdown learning. Understanding learning constraints at home as majority of learners do not have access to devices or data to use for online learning. Many households are depending on schools to provide them with learning resources packs

RELAB is designed as workbook with activities based on the Revised Annual Teaching Plan. The exercises are pitched at a standard to expose learners at Grade 10 & 11 to content at different cognitive levels. The NSC diagnostic reports in different subjects have revealed that learners fail to analyse questions and as a result fail to respond accordingly.

The RELAB is intended to ensure that learners work on exercises that consolidate and reinforce topics taught while at school. These exercises are be completed at home and would receive feedback as groups or individually when at school. It is therefore of paramount importance that teachers assess the work with learners in class, as a way of providing constructive feedback. Teacher are also required to diagnose learner responses, remediate where necessary and plan further intervention.

Educators are encouraged to create whatsapp groups to remind learners on what is expected of them in a particular week/ day(s). Effective utiisation of the RELAB activity book would further ensure that all topics in the RATP are covered simultaneously. Feedback from learners at home will confirm usage of the RELAB material and assist to prepare learners for formal assessments.

Table of Contents

TERM 1 CONTENT QUESTIONS

SAFETY (GENERIC)

1.1 Thabo is busy making a project on the milling machine. Name THREE safety rules that he must adhere to after the milling machine is turned on.

1.2 When you step into the workshop, what are TWO unsafe conditions you need to look out for before you can start working?

1.3 When working with grinding machines (bench- and handheld machines), certain safety aspects apply to grinding wheels. What do these safety aspects entail?

1.4 While working on the lathe, a piece of the workpiece breaks off, hits the safety guard and breaks it. What do you decide to do about the unsafe situation AND why?

1.5 Below is a picture of a cutting machine, FIGURE 1.5:

1.5.1 State the correct name for this cutting machine.

1.5.2 Name two safety devices that this machine must have.

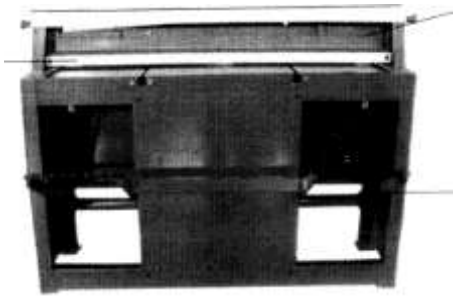


FIGURE 1.5

1.6 After welding a joint it needs to be grinded with an angle grinder to obtain a smooth surface. State THREE safety measures to observe before switching on the angle grinder.

1.7 Give THREE reasons why it is important to wear a welding helmet during arc welding.

1.8 State THREE safety rules to apply when using a portable hand drill machine.

1.9 What safety rule must be adhered to after working procedures on any machine have been completed?

1.10 State THREE safety rules one must adhere to before switching on the horizontal band saw.

1.11 What safety precaution should be adhered to when drilling a small work piece on a drill press?

1.12 State THREE safety rules to be observed when using a hydraulic press.

1.13 Name THREE types of personal protective equipment (PPE) needed when using gas welding equipment.

1.14 Why are you only allowed to light the acetylene with a flint lighter, not with a match or cigarette lighter?

1.15 Give TWO reasons why is it important to wear surgical gloves when treating a co-worker with open wounds.

TERMINOLOGY (SPECIFIC)

2.1 Explain shortly how you will use the ‘Chalk-method’ to centre your workpiece in an independent four jaw chuck.

2.2 Why would you use a mandrel on a lathe? (Refer to the advantages of using a mandrel).

2.3 An external taper of 120mm long is to be cut on the centre lathe. The diameter on the large side is 60 mm and the small diameter is 50 mm, calculate the angle that the compound slide must be set to cut the taper.

2.4 A 3-start square thread is to be cut on the centre lathe with a pitch of 8mm. The outside diameter is 44mm, calculate the following:

2.4.1 The helix angle.
2.4.2 The following angle.
2.4.3 The leading angle

2.5 Describe the function of EACH of the following types of equipment on a centre lathe:

2.5.1 Four-jaw chuck.
2.5.2 Lathe steadies.
2.5.3 Lathe mandrels

2.6 You are required to cut a taper on a lathe using the compound slide. The length of the taper is 105 mm, the large diameter is 78 mm and the small diameter is 62 mm. Calculate the angle at which the compound slide must be set to cut the taper.

2.7 A 7 mm pitch, three-start thread is to be cut on a lathe with a 5 mm pitch lead screw. If the pitch diameter of the thread is 90 mm and a clearance angle of 3° is used, calculate the following:

2.7.1 The helix angle.

2.7.2 The following angle.

2.7.3 The leading angle

2.8 parallel key needs to be manufactured to secure a pulley onto a 60 mm diameter shaft. Calculate the following dimensions of the key:

2.8.1 The width

2.8.2 The thickness

2.8.3 The length

2.9 Identify the milling cutters in FIGURES 2.9.1 and 2.9.2 below.

2.9.1

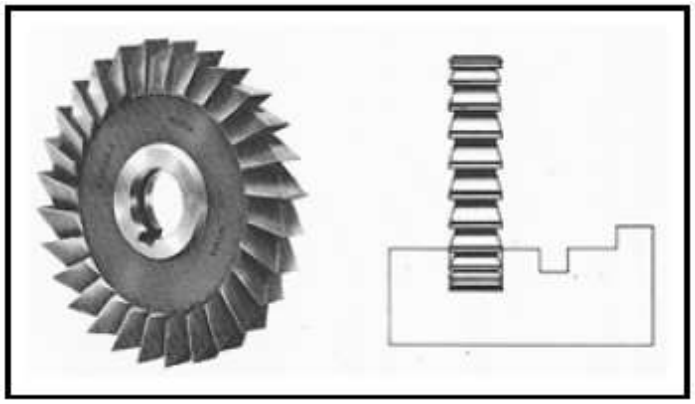


FIGURE 2.9.1

2.9.2

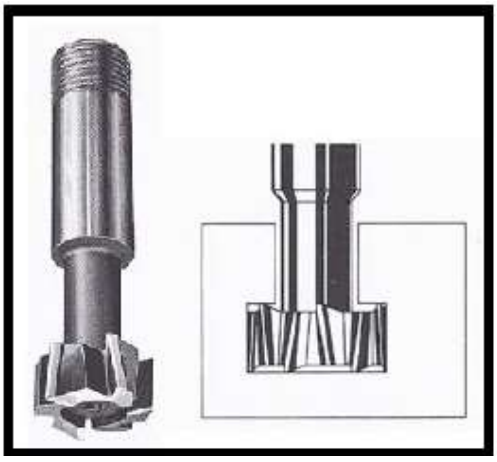


FIGURE 2.9.2

TOOLS (GENERIC)

3.1 The picture below, FIGURE 3.1, shows an ISO Metric screw thread example. Label the parts from (A – E).

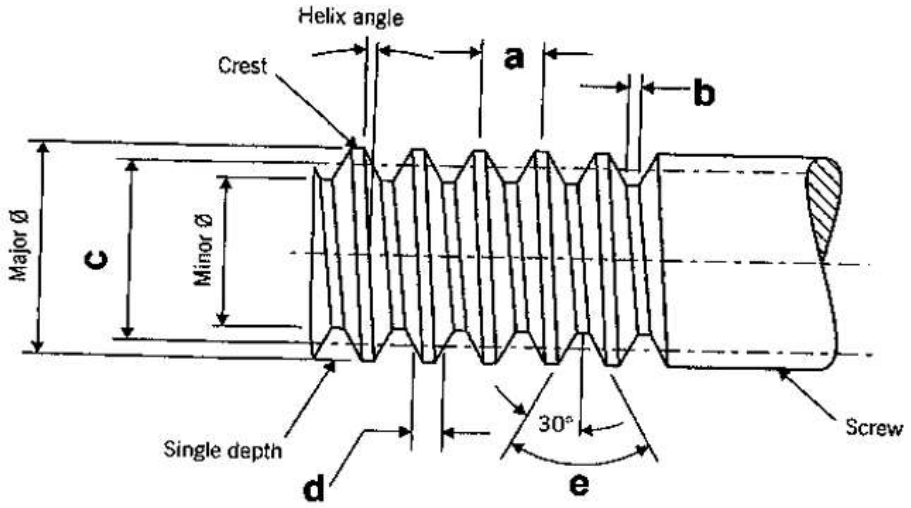


FIGURE 3.1

3.2 Below is a picture, FIGURE 3.2, of a set of taps used to cut internal threads, shortly explain what each tap is used for?

FIGURE 3.2

3.3 What are the THREE main uses of the angle grinder?

3.4 FIGURE 3.4 below shows a type of cutting machine. Answer the questions that follow.

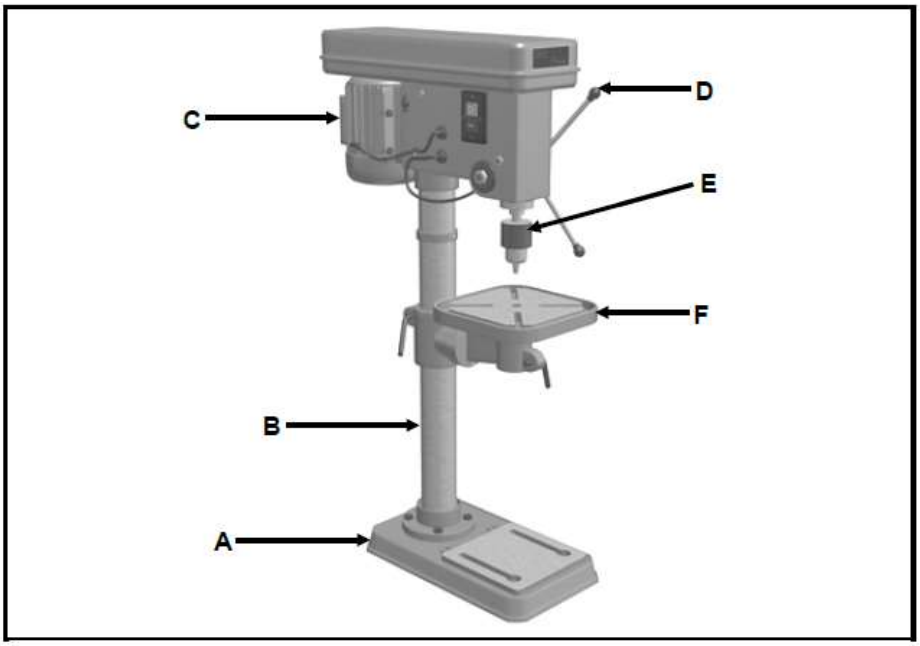


FIGURE 3.4

3.4.1 Identify the machine in FIGURE 3.4 above.

3.4.2 Label A–F.

3.4.3 What is the purpose of part E?

3.5 What is the function of a tap and die set?

3.6 What is the difference between a power saw and a horizontal band saw?

3.7 What is the function of the following equipment?

3.7.1 Roller machine

3.7.2 Hydraulic press

TOOLS (SPECIFIC)

4.1 Name TWO instances in which you would use a dial indicator.

4.2 Name ONE way in which you would take care of the torque wrench.

4.3 Make sketches of the inside micrometre scales to show the following reading: (draw a suitable extension rod and spacer of your choice to fit your reading)

4.3.1 118,88 mm

4.4 Label the Dial indicator in FIGURE 4.4 from A – H.

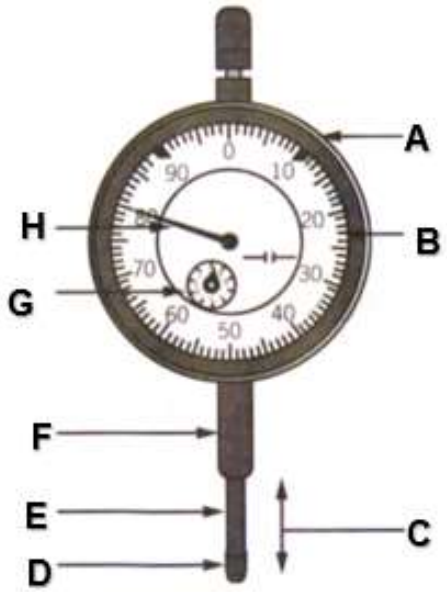


FIGURE 4.4

4.5 While working on a workpiece on the lathe, you need a tool to quickly check the inside measurement of your workpiece that is still accurate.

4.5.1 WHAT tool will you use? AND say why you choice this specific tool.

4.5.2 Name THREE ways how you would take care of this tool named in 4.5.1

4.6 State ONE purpose of the following tools:

4.6.1 Dial indicator.

4.6.2 Telescopic gauge.

4.7 Give THREE reasons for using a torque wrench.

4.8 Determine the reading displayed on the inside micrometer shown in FIGURE 4.8 below.

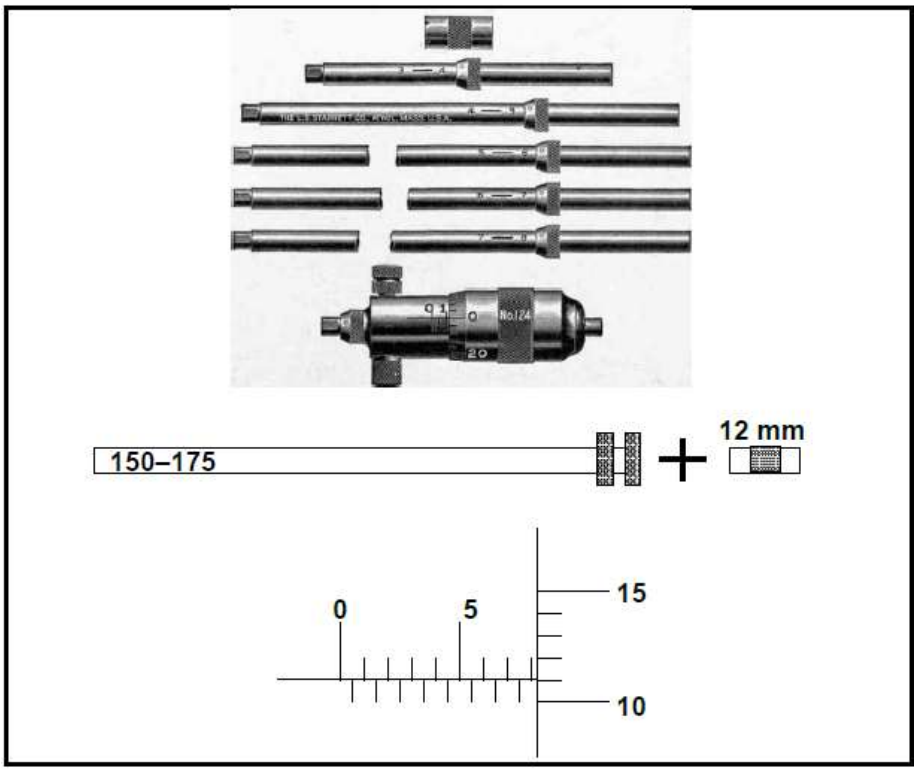
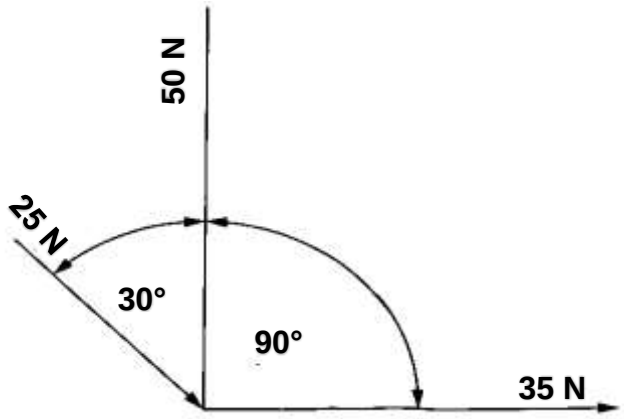


FIGURE 4.8

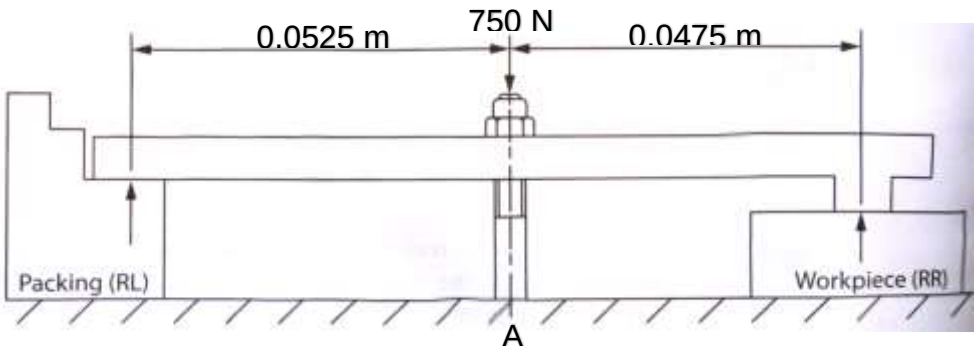
TERM 2 CONTENT QUESTIONS

FORCES (SPECIFIC)

5.1 Calculate the *magnitude* and *direction* of the resultant force (R) in the system of forces below.



5.2 FIGURE 5.2 shows a workpiece being clamped on a milling machine table.



FIGUUR 5.2

5.2.1 Calculate the reaction forces (RL and RR) that are exerted on the workpiece as well as the packing, if the pulling force on the bolt is 750 N.

5.2.3 Calculate the bending moment at point A.

5.4 Calculate the tensile stress in a 30 x 2 round tube if it is subjected to a load of 30 kN.

5.5 The diagram in FIGURE 5.5 below shows a beam supported by two vertical supports, A and B. Two vertical point loads of 800 N and 300 N are exerted onto the beam. Calculate the magnitude of the reactions in supports A and B.

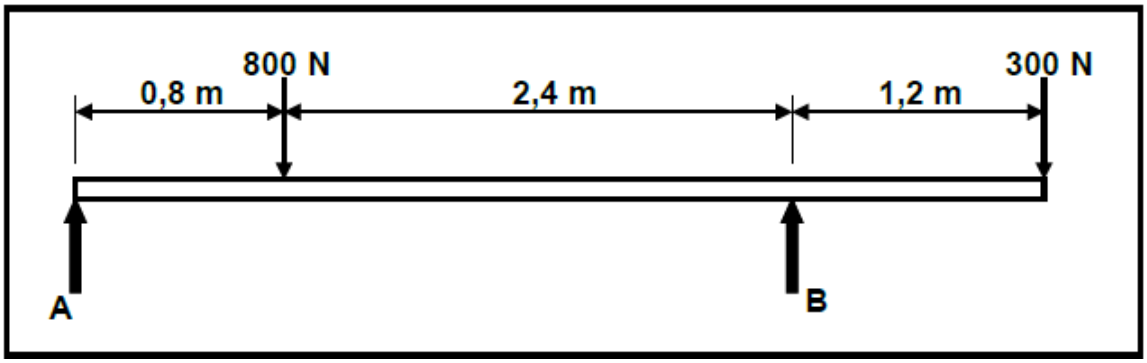


FIGURE 5.5

5.6 Calculate the compressive stress in a brass bush caused by a load of 60 kN. The bush has an outside diameter of 60 mm and an inside diameter of 54 mm. Give your answer in MEGA magnitude.

5.7 FIGURE 5.7 below shows a system of forces with three coplanar forces acting on the same point. Use calculations and determine the magnitude and direction of the resultant force of this system of forces.

(Draw and complete the diagram in FIGURE 5.7. Show ALL the horizontal and vertical components before you do the calculations.)

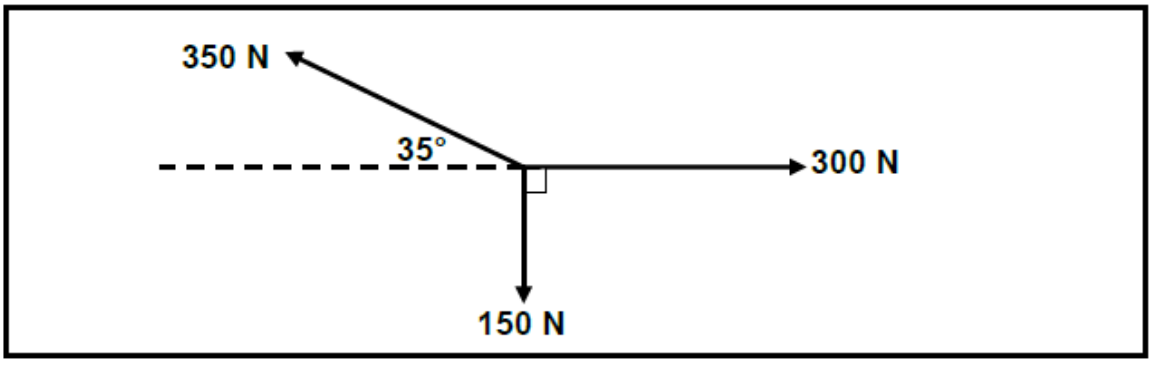


FIGURE 5.7

MAINTENANCE (SPECIFIC)

6.1 Two metal surfaces rub or slide over each other without any lubrication or incorrect lubrication for an extended period. Write briefly what you think will be the outcome/consequences of the scenario.

6.2 Mostly friction is seen as a disadvantage. Where can we use friction where it will be an advantage? Refer to THREE different situations/parts.

6.3 What is the meaning of the following terms?

6.3.1 Static balancing.

6.3.2 Dynamic balancing.

6.4 Briefly explain how to do the 'trial-and-error' method of balancing.

6.5 State THREE causes of the malfunctioning of lathes and milling machines.

6.6 Explain overheating that causes friction on a machine when lubrication is inadequate:

6.7 State ONE procedure that may be followed to reduce physical wear on the milling cutter of a milling machine.

6.8 State TWO results of an unbalanced work piece in a lathe.

JOINING METHODS (SPECIFIC)

7.1 Explain, with the aid of simple sketches, the difference between single- and multiple-start screw threads.

7.2 A 4 mm pitch, two-start screw thread must be cut on a centre lathe. Calculate the lead of the screw thread.

7.3 A M12 x 1.75 metric V-screw thread must be cut on a mild steel shaft. Calculate the following:

7.3.1 the depth of the screw thread

7.3.2 the height of the screw thread

7.4 A fitter must drill a hole to cut a M8 x 1,5 internal screw thread. Calculate the drill size he needs to drill the hole.

7.5 Why would a multi-start thread be preferred in some instances to a single start thread?

7.6 Draw a neat sketch of an isometric V-screw thread and indicate the following on the sketch:

7.6.1 Pitch

7.6.2 Screw thread angle

7.6.3 Effective diameter

7.6.4 Crest

7.7 The pitch of a M20 V-screw thread is 2,5 mm.
Calculate the following:

7.7.1 The depth of the screw thread.

7.7.2 The effective diameter of the screw thread.

7.8 Explain, with the aid of simple sketches, the difference between single- and multiple-start screw threads.

TERM 3 AND 4 CONTENT QUESTIONS

MATERIALS (GENERIC)

8.1 Describe the following terms used to identify the properties of metals:

8.1.1 Hardness.

8.1.2 Elasticity.

8.1.3 Malleability.

8.1.4 Toughness.

8.2 What is the role of coke in the blast furnace? (Name ONE)

8.3 In which THREE categories are steel divided into?

8.4 What is the study of metals called?

8.5 The blast furnace is used to melt and purify iron ore, answer the following questions:

8.5.1 Which materials are added to the iron ore to extract impurities from the iron ore? (Name TWO)

8.5.2 5.8.2 What is the product (type of iron) that is extracted from the oven?

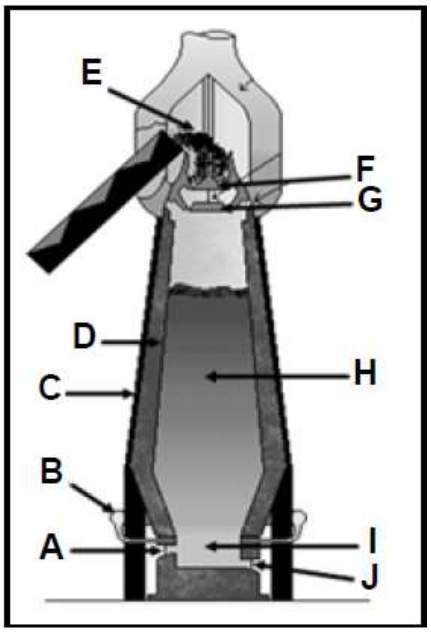
8.6 What is the waste product (impurities) called that is also drained after the melting process?

8.7 What determines the hardness of steel?

8.8 What FOUR ingredients (elements) are needed to manufacture iron?

8.9 What is iron ore?

8.10 FIGURE 8.10 below shows a cross-sectional view of a blast furnace. Label **A**–**J**.



FIGUUR 8.10

SYSTEMS AND CONTROL (SPECIFIC)

9.1 A drive pulley of 158 mm in diameter rotates at 20 r / sec and drives a 401 mm pulley in diameter by means of A V-belt. Calculate:

9.1.1 The rotational frequency of the driven pulley in rpm.

9.2 FIGURE 9.2 shows a gear system. A drive shaft A on the input shaft has 32 teeth and combs with a gear B with 16 teeth on an intermediate shaft. On the intermediate axle there is another 34-T drive C with a 12-teeth gear D at a second intermediate shaft. If drive A turns at 900 rpm what is the speed of output shaft D?

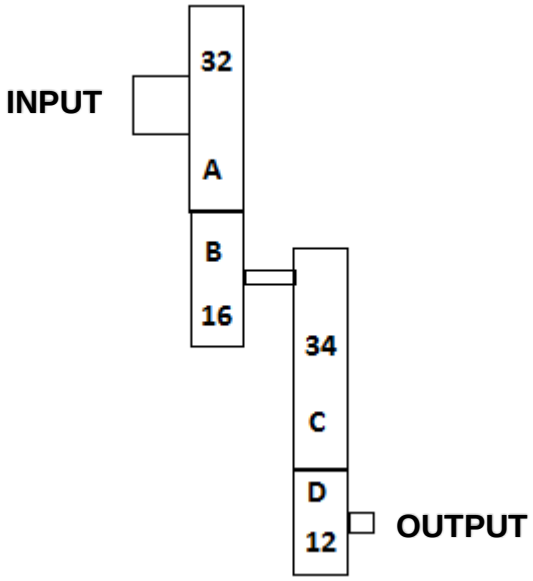
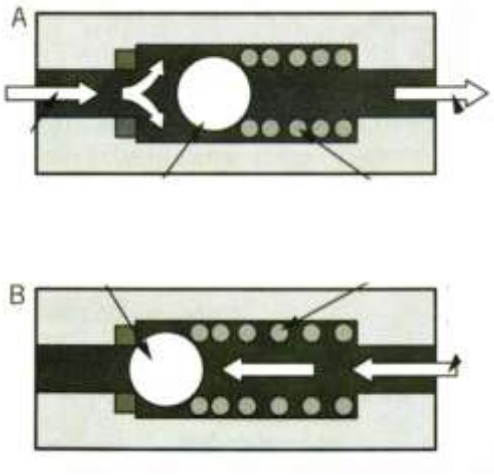


FIGURE 9.2

9.3 The pressure in the hydraulic fluid in a cylinder is 4000 Pa and the diameter of the piston is 250 mm. Calculate the force exerted by the piston. (Tip - first calculate the area of the piston)

9.4 The figures below show a valve in the open position (A) and one in the closed position (B).



9.4.1 Which valve is shown?

9.4.2 What is the function of the valve?

9.5 Name the names of TWO pressure gauges found in pneumatic and hydraulic systems.

9.6 State THREE advantages of a belt drive compared to a gear drive.

9.7 Calculate the force on a piston rod, 25 mm in diameter, during the forward stroke. The diameter of the piston is 120 mm and the pressure in the cylinder is 1,2 MPa.

9.8 FIGURE 9.8 below shows a belt-drive system with a 230 mm driver pulley rotating at 1 440 r/min. The effective tensile force in the system is 165 N.

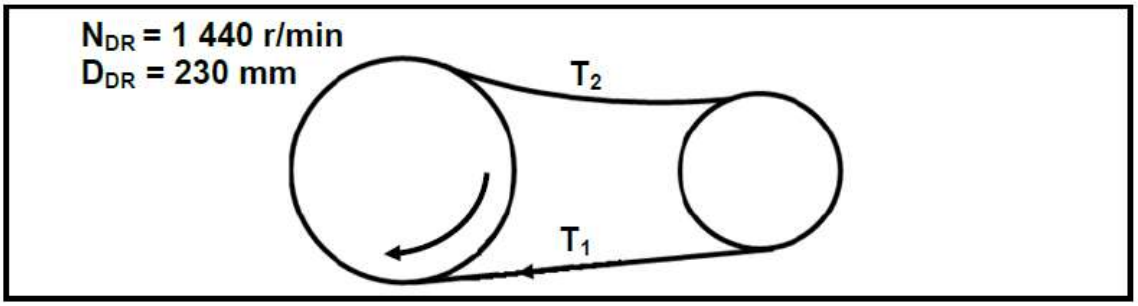


FIGURE 9.8

Determine, by means of calculations:

9.8.1 The belt speed in $m.s^{-1}$

9.8.2 The power transmitted in kW.

9.9 FIGURE 9.9 illustrates a gear system in a gearbox. Gear A, with 102 teeth, rotates clockwise at 120 r/min.

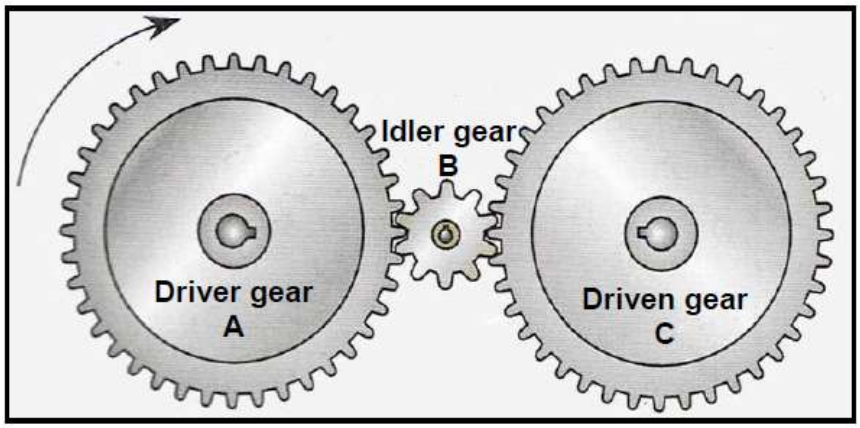


FIGURE 9.9

9.9.1 Identify the direction of rotation of gear C.

9.9.2 Calculate the number of teeth on gear C if it must rotate at 80 r/min.

9.10 The chain-drive system of a bicycle is shown in FIGURE 9.10 below. Calculate the gear ratio of the system.

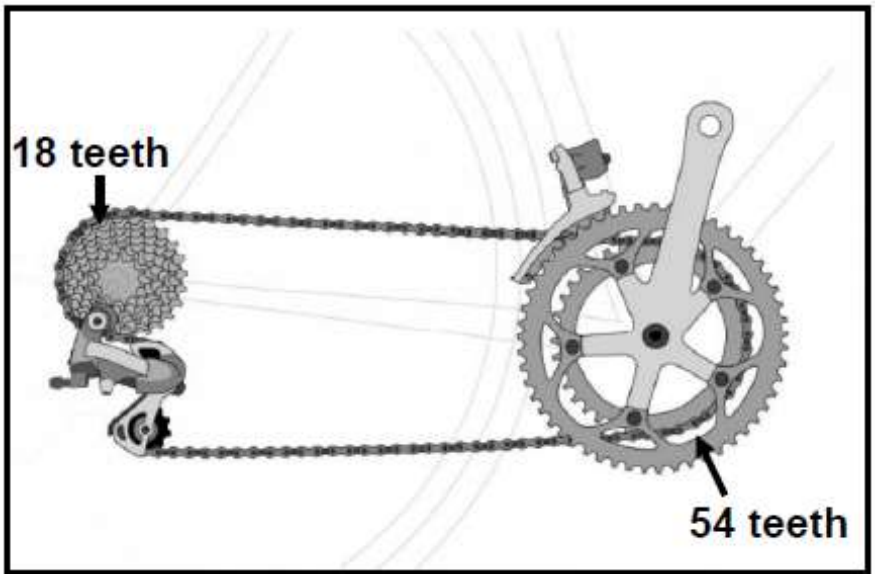


FIGURE 9.10

PUMPS (SPECIFIC)

10.1 The operating principle of a piston pump is the forward and backward or up and down movement that develops from a circular motion.

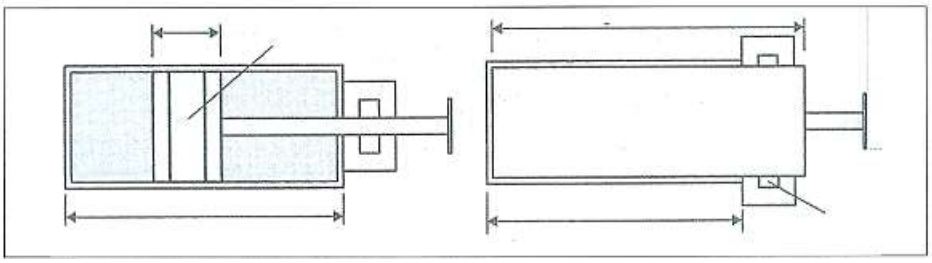


FIGURE 10.1

10.1.1 12.1.1 Name the TWO main differences between a piston pump and plunger pump.

10.2 Pumping is not an indication of the amount of liquid that is delivered, but is lost. List FOUR reasons for pumping.

10.3 Name the parts of the centrifugal pump (FIGURE 10.3) used as a water pump in a motor vehicle marked 1-6.

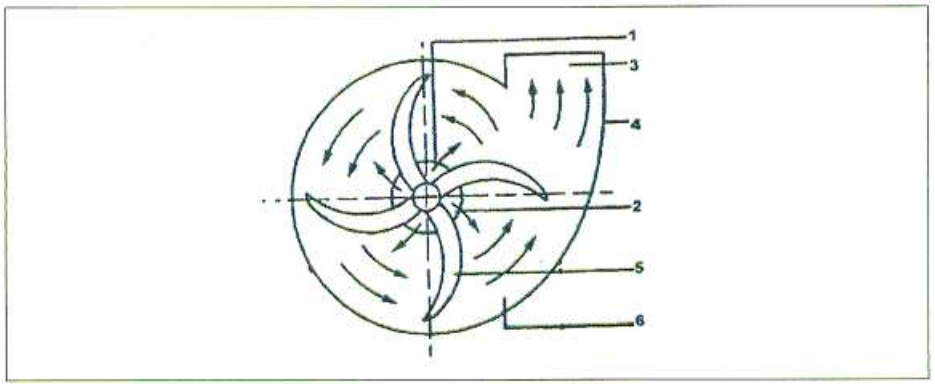


FIGURE 10.3

10.4 Name TWO applications of a mono pump.

10.5 State TWO advantages of centrifugal pumps.

10.6 Name the THREE main moving parts of a reciprocating pump.

10.7 State TWO disadvantages of a gear pump.

10.8 Different types of impellers are selected according to the use of the centrifugal pump. Identify the THREE impellers shown in FIGURES 10.8.1, 10.8.2 and 10.8.3 below.

10.8.1

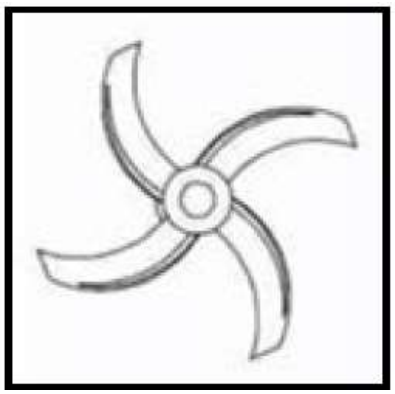


FIGURE 10.8.1

10.8.2

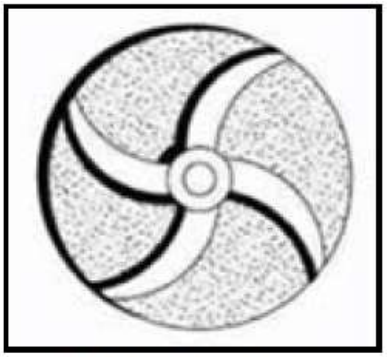


FIGURE 10.8.2

10.8.3

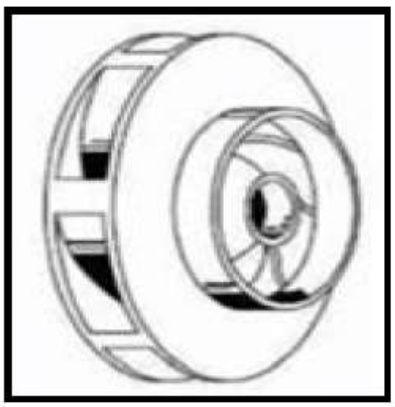


FIGURE 10.8.3

FORMULA SHEET

1. STRESS AND STRAIN

1.1 $Stress = \frac{Force}{Area}\ or\ (\sigma = \frac{F}{A})$

1.2 $Area_{Shaft} = \frac{\pi d^2}{4}$

1.3 $Area_{Pipe} = \frac{\pi(D^2 - d^2)}{4}$

1.4 $Area_{square\ bar} = length \times breadth$

2. KEYS

2.1 $Width\ of\ key = \frac{Diameter\ of\ shaft}{4}$

2.2 $Thickness\ of\ key = \frac{Diameter\ of\ shaft}{6}$

2.3 $Length\ of\ key = 1{,}5 \times Diameter\ of\ shaft$

2.4 Standard taper for taper key: 1 in 100 or 1 : 100

3. SCREW THREAD

3.1 *Lead = number of starts x pitch*

3.2 *Helix angle:* $tan\theta = \frac{lead}{\pi.diameter}$

3.3 *Leading tool angle = 90° – (helix angle + clearance angle)*

3.4 *Following tool angle = 90° + (helix angle – clearance angle)*

3.5 *Depth of thread : D = 0,613 x P*

3.6 *Height of thread: H = 0,88603 x P*

3.7 *Pitch diameter of thread :* $= OD - 2 \times [\frac{3 \times H}{8}]$

4. TAPER TURNING

4.1 *Compound slide angle: tan* $\frac{\theta}{2} = \frac{D-d}{2L}$

5. GEARS

5.1 N_A x T_A = N_B x T_B

5.2 $\frac{N_{INPUT}}{N_{OUTPUT}} = \frac{\textbf{Product of number of teeth on Driven gears}}{\textbf{Product of number of teeth on Drive gears}}$

6. PULLEYS

6.1 π x D_A X $N_A = \pi$ x D_B x N_B

6.2 Effective tension in belt = $T_{(A)} – T_{(B)}$

6.3 Force transmitted = Force N x distance travelled in m/s

7. HYDRAULICS

7.1 Pressure = $\frac{Force}{Area}$

7.2 Volume = $SL\ x\ A$

7.3 Area = $\frac{\pi d^2}{4}$