Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2011

MECHANICAL TECHNOLOGY

MARKS: **200**

TIME: **3 hours**

* M C H T E A *

This question paper consists of 18 pages, a formula sheet and answer sheet.

INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the spaces provided on the answer book.
2. Answer ALL the questions.
3. Read ALL the questions carefully.
4. Number and answer according to the numbering system used in the questions.
5. Write neatly and legibly.
6. Show all calculations and units.
7. Candidates may use non-programmable scientific calculators and drawing/mathematical instruments.
8. The value of the gravitational force should be taken as 10 m/s^2.
9. Use the criteria below to assist you in managing your time.

QUESTION	ASSESSMENT STANDARDS	CONCEPTS COVERED	MARKS	TIME
1	1 – 9	Multiple-choice questions	20	18 minutes
2	6 and 8	Applied Mechanics	50	45 minutes
3	2	Tools and equipment	20	18 minutes
4	3	Materials	20	18 minutes
5	1, 4 and 5	Manufacturing process, construction methods and safety	50	45 minutes
6	7 and 9	Pumps and maintenance	40	36 minutes
		TOTAL:	**200**	**180 minutes**

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 1 – 9)

Choose the correct answer from those indicated by A, B, C and D.
In your script write down the number of the question and then your choice, for example: 1.21 E.

1.1 Which of the following safety aspects is NOT the responsibility of the employee?

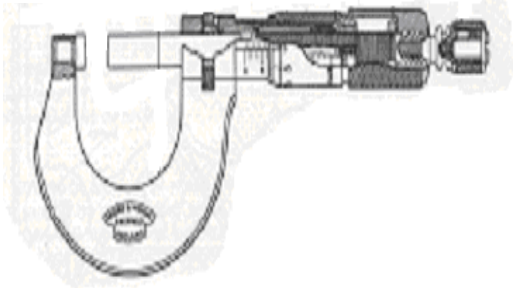
A Sufficient lightning.
B Responsible use of tools and equipment.
C Correct clothing.
D Stop anyone using a dangerous machine. (1)

1.2 Name TWO types of safety equipment to be used when working with arc welding.

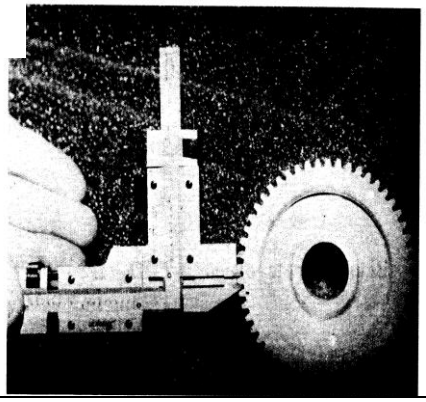
A Helmet and damp mask.
B Aprons and gloves.
C Safety shoes and welding goggles.
D Gloves and face shield. (1)

1.3 Which ONE of the following tools shown below is used for precision measuring the diameter of a round bar?

A

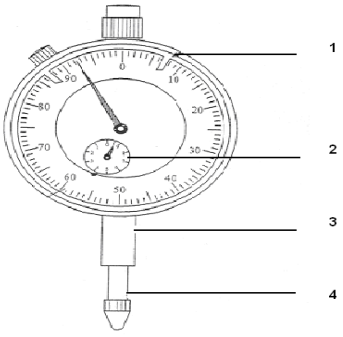


B



C

D



(1)

1.4 Determine the value of the depth micrometer reading shown below in FIGURE 1.4.

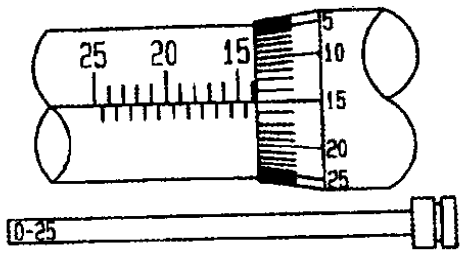


FIGURE 1.4

A 16,15 mm
B 36,15 mm
C 13,65 mm
D 14,15 mm (1)

1.5 Gauge blocks are the most accurate at a temperature of ...

A 19° C.
B 36° C.
C 20° C.
D 26° C. (1)

1.6 What is the first step in heat treatment of steel?

A Case hardening.
B Hardening.
C Tempering.
D Normalising. (1)

1.7 When quenching media is used for the heat treatment of steel one of the requirements for oil is that it must have a high flash-point. That means …

A that the oil must not give off smoke.
B that the oil must not ignite easily.
C that the oil must ignite easily.
D that the oil must give of white smoke. (1)

1.8 Soft solder is a … joining application.

A Not one of the below mentioned
B temporarily
C permanent
D semi-permanent (1)

1.9 Identify the type of welding position that is shown in FIGURE 1.6.

FIGURE 1.6

A Overhead position
B Horizontal position
C Vertical position
D Not one of the above-mentioned (1)

1.10 Determine the value of the force moment as shown in FIGURE 1.10.

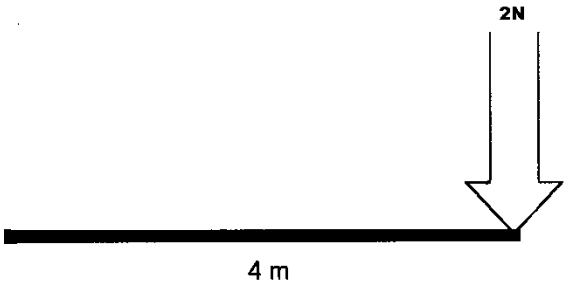


FIGURE 1.10

A 6 Nm
B 8 N/m
C 6 N/m
D 8 Nm (1)

1.11 Which type of force is experienced in FIGURE 1.11?

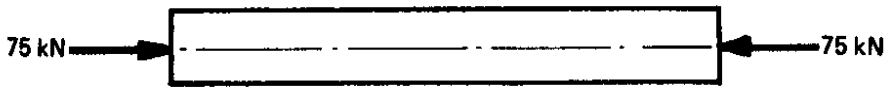


FIGURE 1.11

A Sheer force
B Compression force
C Tensile force
D Not one of the above. (1)

1.12 Friction can be applied positively. Which ONE of the following friction forces does not fit?

A Tyres and tar surface
B Taper shank drill and sleeve
C Clutch and flywheel
D Bearing and crank shaft (1)

1.13 Wheel alignment has a lot to do with road holding but also with tyre life. If a person tells you that your vehicle has TOE-IN, what will the signs be on the tyre surface?

A Sharp edges of the tread pointing to the centre of the car.
B Sharp edges of the tread pointing to the outside of the car.
C The middle of the tread is worn.
D The outside of the tread is worn. (1)

1.14 Study the sketch and identify the type of gear drive.

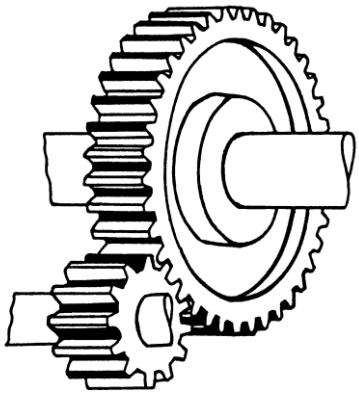


FIGURE 1.14

A Worm gear drive
B Bevel gear drive
C Single helical gear drive
D Single spur gear drive (1)

1.15 Screw thread has basic applications. Which ONE of the following DOES NOT fit?

A To hold parts together.
B Not to transmit motion.
C To transmit power.
D To exert pressure. (1)

1.16 Pump slip is the difference between the theoretical flow rate and the real flow rate. Which cause does not fit?

A Weak valve spring
B Loose flange joints
C Faulty foot valve
D A strainer that is below the fluid level. (1)

1.17 Identify the type of pump that is illustrated in FIGURE 1.17.

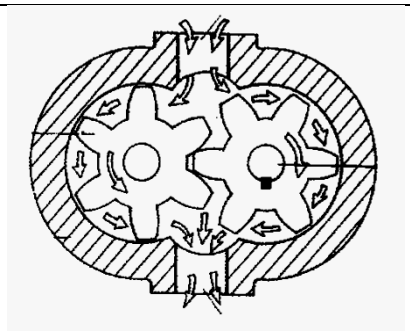


FIGURE 1.17

A Piston pump
B Vane pump
C Rotor pump
D Gear pump (1)

1.18 The aim for maintenance of mechanical equipment is …

A to stop machinery regularly.
B to increase the lifespan of the equipment.
C to operate at a higher speed.
D to operate at average speed. (1)

1.19 Identify the part of the centre lathe that is shown in FIGURE 1.19.

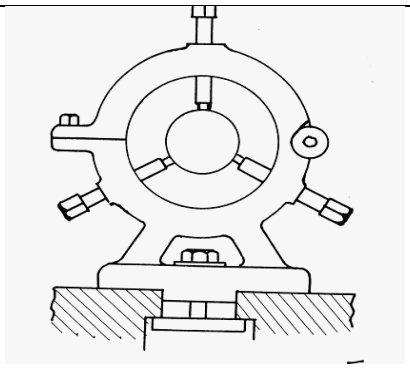


FIGURE 1.19

A Tool post
B Compound slide
C Fixed lathe steady
D Movable lathe steady (1)

1.20 A belt drive system has ...

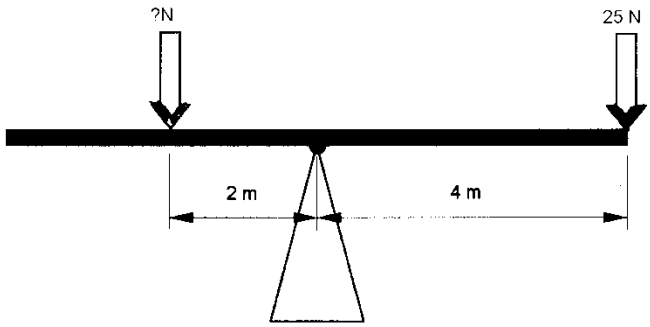
A two gear wheels that mesh together.
B two pulley wheels and a belt.
C two gear wheels and a chain.
D not one of the above-mentioned (1)

[20]

QUESTION 2: APPLIED MECHANICS

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 6 AND 8)

2.1 Determine through calculations the unknown force (?N).



(4)

2.2 2.2.1 You are given a train of bevel gears labelled A and B. Identify gear A as seen in FIGURE 2.2. (1)

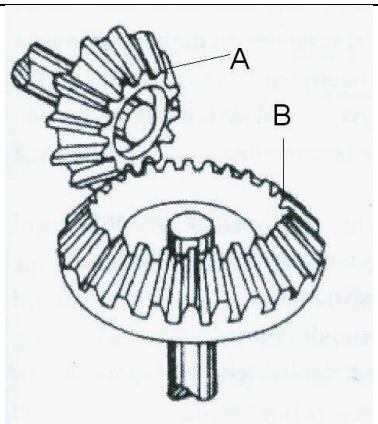
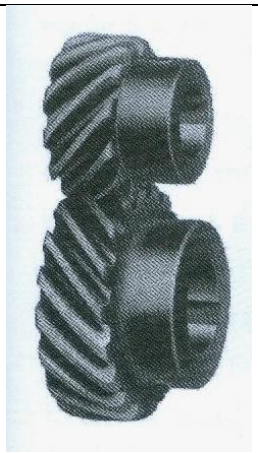
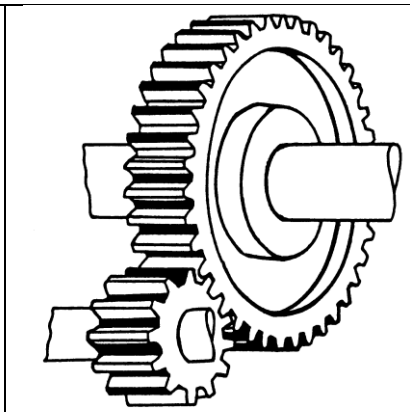


FIGURE 2.2

2.2.2 Name FIVE advantages of single helical gears over that of a spur gear. (5)



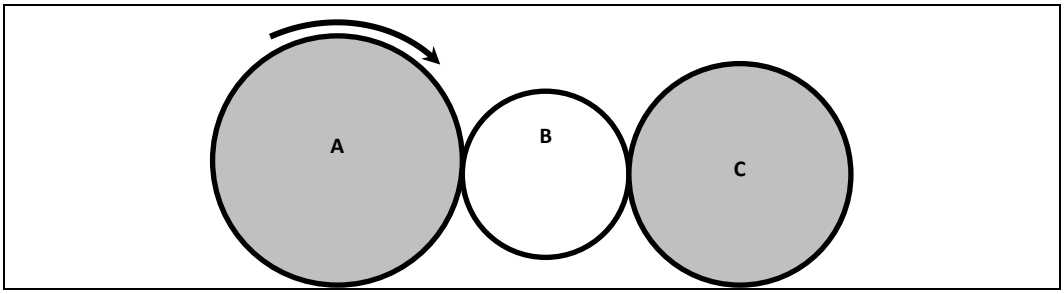


2.3 The driving efficiency of a belt drive is influenced by factors such as belt slip. An idler pulley can solve the problem.

2.3.1 Idler pulleys have two functions. Name the TWO functions. (2)

2.3.2 Where will the idler pulley be placed? (1)

2.4 If gear A is turning clockwise, in which direction will gear C turn? Motivate your answer.



(2)

2.5 2.5.1 FIGURE 2.5 shows a spanner which is used to tighten a nut. Calculate the force(P) that must be applied to create a torque of 27,5 N.m. if the length of the spanner is 350 mm. (4)

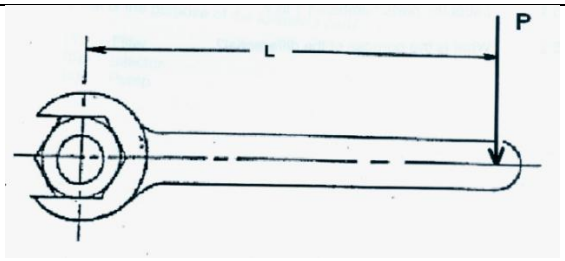
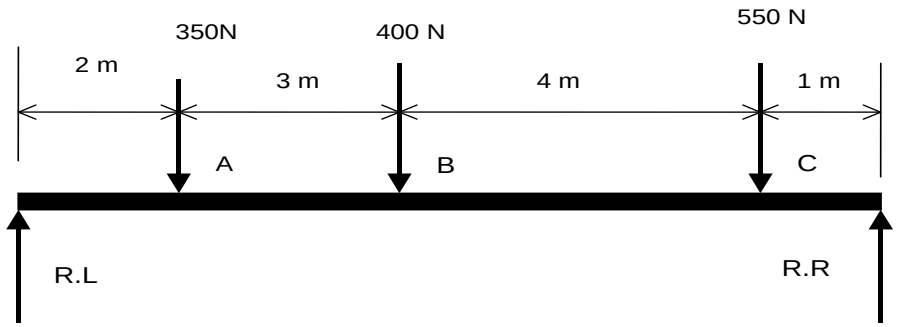


FIGURE 2.5

2.5.2 Define 'torque'. (3)

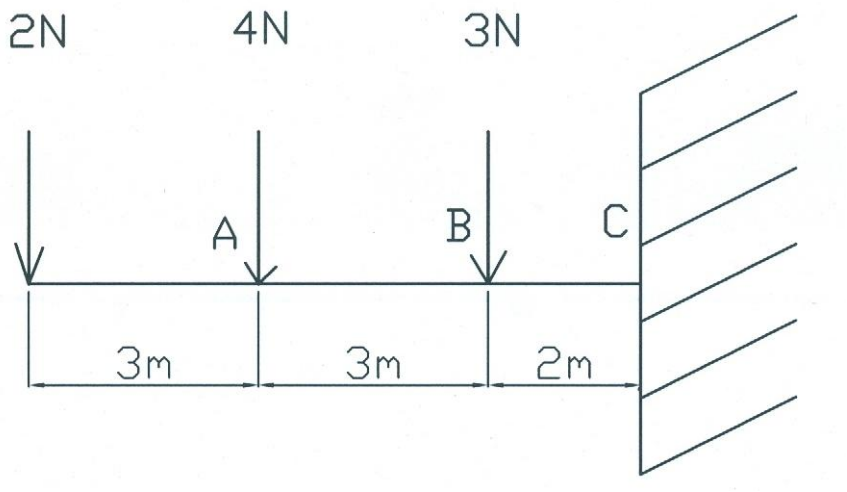
2.5.3 Explain your understanding of a beam with uniformly distributed loads (UDLs). Give a practical explanation. (4)

2.6 The Sand River flows through the St. Francis village. The high school is on the other side of the river. The river was in flood and damaged the bridge. Now the learners must use the alternative route. The diagram below is of a bridge that is used to cross the river. The maximum mass that the bridge can carry at any given moment is 250 kilogram.



2.6.1 Prove by means of calculations, that the bridge is safe to be used by the learners. (Hint: calculate the magnitudes of the reactions.) (8)

2.7 A cantilever is subjected to three point loads. Calculate the bending moments for points A,B and C and draw the sheer force and bending moment diagrams according to the following scale:
Sheer force diagram: 10 mm = 1 m
10 mm = 2 N
Bending moment diagram: 10 mm = 12 N.m



(12)

2.8 Cam mechanisms are commonly used to operate valves in motor vehicles. All cam mechanisms consist of at least three parts. Name these THREE parts. (3)

2.9 What is the function of a clutch? (1)

[50]

QUESTION 3: TOOLS AND EQUIPMENT

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 2)

3.1 You are an apprentice and work for experience in the measuring room. The instructor ordered you to go and fetch this precision measuring instrument shown below.

3.1.1 Identify the measuring instrument shown in FIGURE 3.1. (1)

3.1.2 Label the parts numbered 1 to 8. (8)

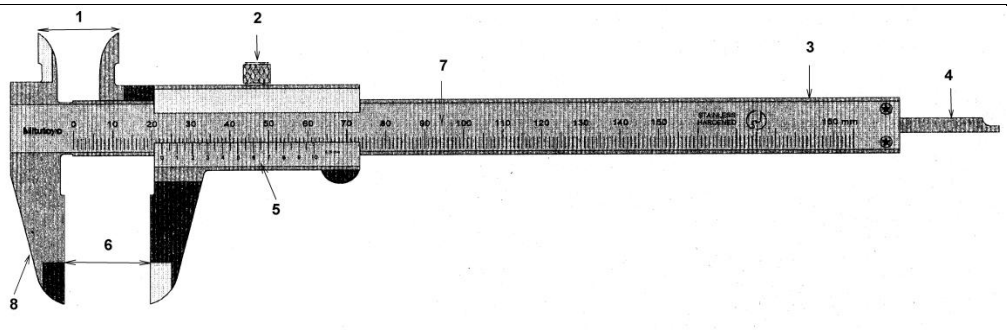


FIGURE 3.1

3.2 The sine bar consist of a hardened bar with two pins or plugs. It is used in conjunction with other instruments to test work pieces as shown in FIGURE 3.2.

Name the THREE essential features to ensure the accuracy of a sine bar. (3)

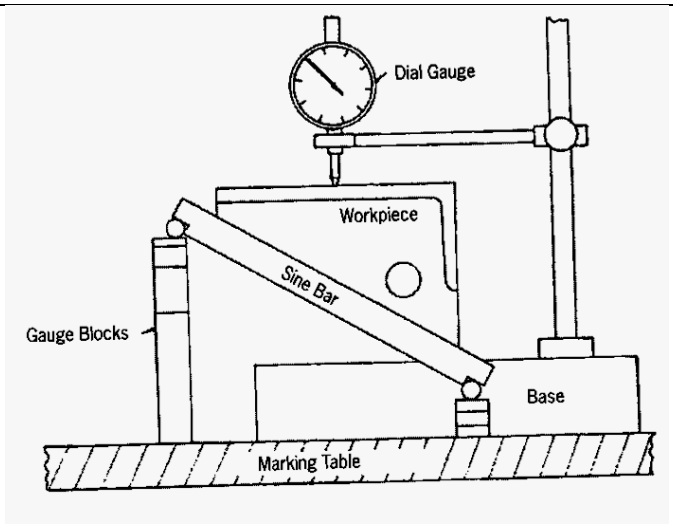


FIGURE 3.2

3.3 Give <u>THREE</u> reasons for using a torque wrench on an engine. (3)

3.4 A comparator is an instrument that compares an unknown dimension with a given size. Name TWO advantages of a comparator. (2)

3.4.1 Identify the instrument as shown below in FIGURE 3.5. (1)

3.4.2 Explain the function of the instrument. (2)

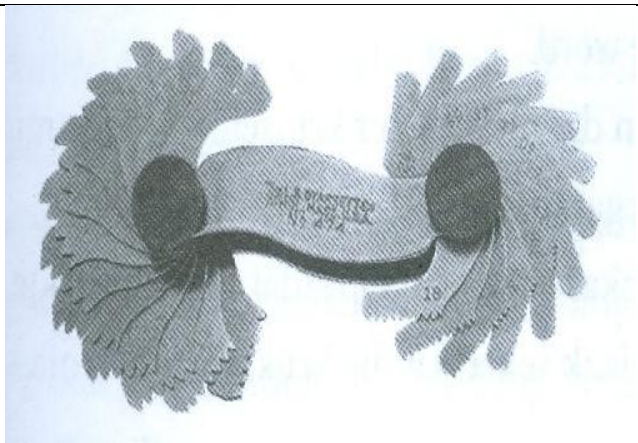


FIGURE 3.5

[20]

QUESTION 4: MATERIALS

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 3)

4.1 Choose a definition from COLUMN B that matches a process in COLUMN A. Write only the letter next to the question number, for example 4.1.5 E.

COLUMN A (Process)		COLUMN B (Definition)	
4.1.1	Tempering	A	The metal is heated to a specified temperature and then cooled in still air
4.1.2	Annealing	B	In this process the outer case is turned into high-carbon steel
4.1.3	Normalising	C	The metal is heated to a suitable temperature and quenched again
4.1.4	Case-hardening	D	The metal is heated to a specified temperature and then cooled slowly in the furnace

(4)

4.2 The hardening of steel can be achieved through a specific heat treatment which depends on three factors. Name the THREE factors. (3)

4.3 Cooling methods of heated steel deliver certain categories of quenching properties. Name FIVE different types of quenching media. (5)

4.4 Choose from COLUMN B tools that matches quenching colour in COLUMN A. Write only the letter next to the question number, for example 4.4.5 E.

COLUMN A (quenching colour)		COLUMN B (tools)	
4.4.1	Straw	A	Springs
4.4.2	Light yellow	B	Hammer faces, wood chisel, cold chisel
4.4.3	Pale blue	C	Punches, taps and die and hacksaw blades
4.4.4	Gold	D	Lathe centre, cutting tools for lathe

(4)

4.5 Name THREE advantages of quenching in brine. (3)

4.6 Why should steel parts be agitated during quenching? (1)

[20]

QUESTION 5: MANUFACTURING PROCESS, CONSTRUCTION AND SAFETY

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 1, 4 AND 5)

5.1 Andile works on a centre lathe and must cut a right-hand three start square thread. Name FIVE safety precautions to be observed when using a centre lathe. (5)

5.2 Gert is a qualified welder. He receives an instruction from his foreman to complete a job over the weekend. Examine the following welding instructions and write down the information for Gert.

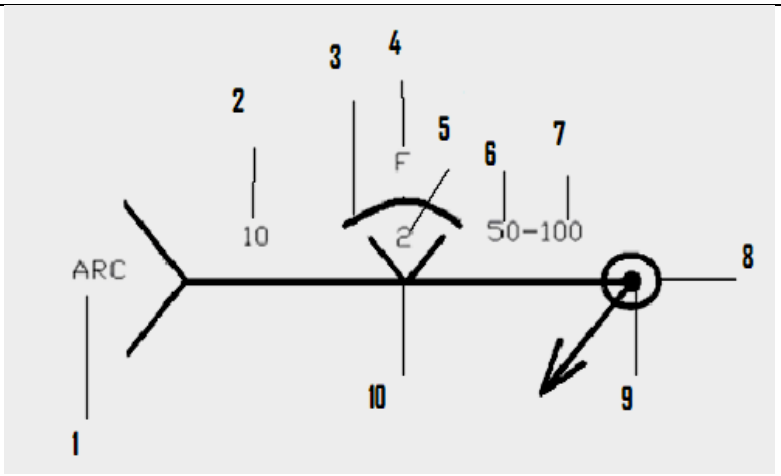


FIGURE 5.2 (10)

5.3 Complete the missing **SI-base- and derived units.**

		METAL	**COLOUR CODE**
5.3.1		CAST STEEL	? (1)
5.3.2		STAINLESS STEEL	? (1)
		ABBREVIATION	**MEANING**
5.3.3		RPM	? (1)
5.3.4		PCD	? (1)
	BASE QUANTITY	**NAME**	**SYMBOL**
5.3.5	?	KILOGRAM	kg (1)

5.4 There are FIVE main types of welding joints. These joints can be brazed, gas welded or arc welded. Draw neat sketches to illustrate the following joints.

5.4.1 T-joint (2)

5.4.2 Corner joint (2)

5.4.3 Butt joint (2)

5.4.4 Edge-joint (2)

5.4.5 Lap joint (2)

5.5 You are working at 'ALL STEEL' where a client needs three pieces of flat iron 250 mm in length each. After you marked the lengths you will use an angle grinder to cut the correct size. Name FOUR safety precautions to observe when using the angle grinder. (4)

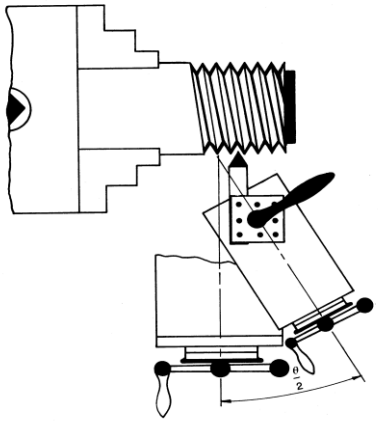
5.6 Petro is working at East London's 'fast fit centre" and must replace a motors exhaust system. He will use an oxyacetylene gas welding apparatus.

Describe in SIX steps how the start up (ignite) procedure will work. (6)

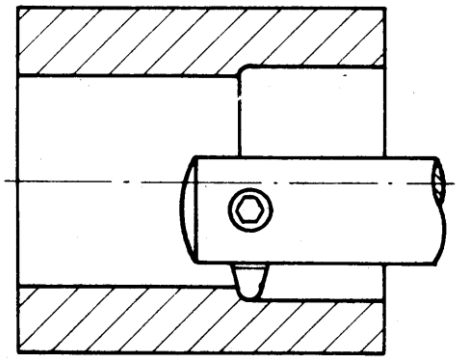
5.7 Your teacher instructed you and Andile to cut a 50 mm solid round bar using a power saw. Identify FIVE safety rules which must be observed when using a power saw. (5)

5.8 Identify the turning operations in the figures below.

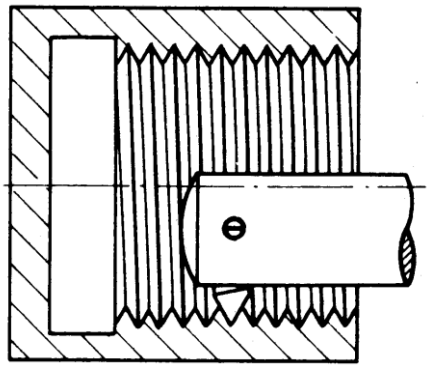
5.8.1



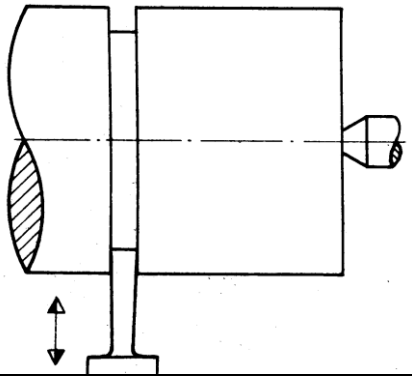
5.8.2



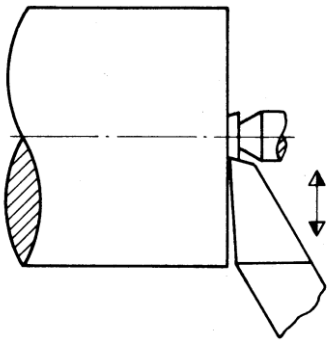
5.8.3



5.8.4



5.8.5



(5)
[50]

QUESTION 6: PUMPS AND MAINTENANCE

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 7 AND 9)

6.1 Define the term, 'friction'. (2)

6.2 Explain the following causes of mechanical failure:

6.2.1 Inadequate maintenance (2)

6.2.2 Insufficient lubrication (2)

6.2.3 Inadequate cooling (2)

6.3 Name THREE different types of friction. (3)

6.4 Name FOUR important safety checks that need to be done before wheel alignment is carried out. (4)

6.5 Complete the sentence by writing the missing word next to the number.

6.5.1 When the wheels (tyres) of a vehicle are out of balance you will notice it through a vibration on the … (1)

6.5.2 The procedure of balancing is when the operator attach the tyre to a wheel (a) … machine and fit a small (b) … to the rim of the wheel. (2)

6.6 The most common pump known to all of us is the bicycle pump. Its main purpose is to inflate a flat bicycle tyre.

6.6.1 What are the TWO main differences between a piston pump and plunger pump? (2)

6.6.2 What is the meaning of the term "pump slip" with regard to a pump? (2)

6.7 FIGURE 6.10 shows a centrifugal pump.

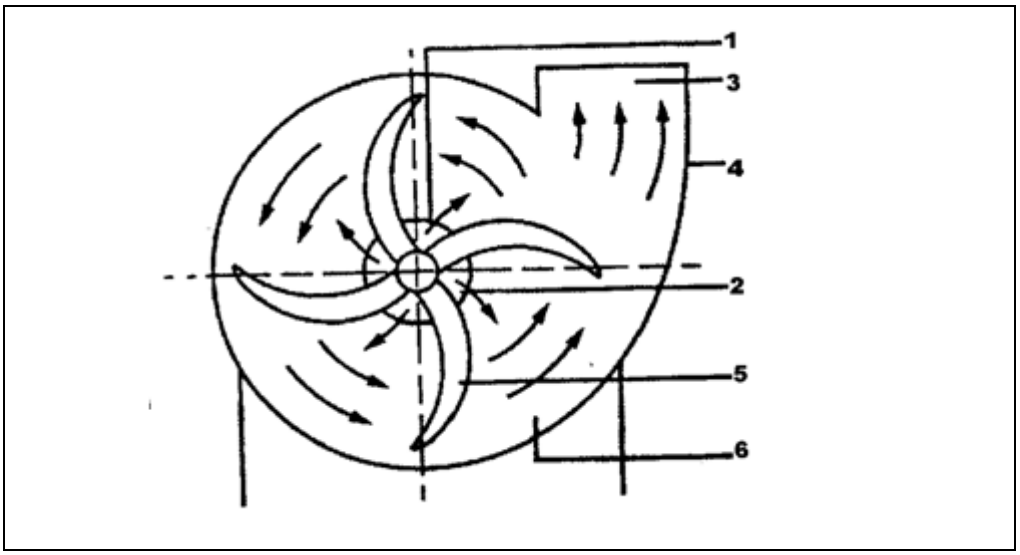


FIGURE 6.10

6.7.1 Label the parts marked 1 − 6. (6)

6.8 Centrifugal pumps offer advantages over that of the reciprocating pump. Name SIX advantages. (6)

6.9 Gear pumps are mostly used in hydraulic systems.

6.9.1 Name FOUR advantages of a gear pump. (4)

6.9.2 Name TWO disadvantages of a gear pump. (2)

[40]

TOTAL: 200

MECHANICAL TECHNOLOGY – GRADE 11 – FORMULA SHEET

1. **Gauge blocks**
   Set nr. M.50

Range	increment in mm	number of blocks
1,0025 to 1,0075	0,0025	3
1,01 to 1,09	0,01	9
1,1 to 1,9	0,1	9
1 to 25	1,0	25
50; 75; 100		3
0,5		1

2. **Friction**:
   $F = \mu \times N$ were
   $F = force\ of\ friction$
   μ = co-efficient of friction
   N = Normal force

3. **Torque:** T
   T = Force x Distance were
   T = N.m

MECHANICAL TECHNOLOGY: ANSWER SHEET

NOVEMBER 2011 **GRADE 11**

QUESTION 1 is to be answered on THIS ANSWER SHEET.

GRADE 11: _____ **NAME:** _____

Indicate the correct answer with a cross (X).

Example: 1.21 | A | B | ~~C~~ | D |

ANSWER SHEET/ANTWOORDBLAD				
QUESTION/VRAAG		**1**	**(MULTIPLE-CHOICE QUESTIONS) /(MEERVOUDIGE-KEUSE VRAE)**	
1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D
1.11	A	B	C	D
1.12	A	B	C	D
1.13	A	B	C	D
1.14	A	B	C	D
1.15	A	B	C	D
1.16	A	B	C	D
1.17	A	B	C	D
1.18	A	B	C	D
1.19	A	B	C	D
1.20	A	B	C	D
TOTAL				

Tear off and submit with answer book.