Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2012

MECHANICAL TECHNOLOGY MEMORANDUM

MARKS: 200

This memorandum of 10 pages.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

(Learning Outcome 3: Assessment Standards 1 – 9)

1.1	A	B	~~C~~	D
1.2	~~A~~		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

(20 x 1) (20)

QUESTION 2: APPLIED MECHANICS

(Learning Outcome 3: Assessment Standards 6 and 8)

2.1 2.1.1 Take moments about RL:

Clock wise = anti-clock

(2 x 2) + (6 x 3) + (4 x 6) = (RR x 8) √

√

RR = 5,75 N √

Take moments about RR:

Clock wise = anti-clock

(RL x 8) = (4 x 2) + (6 x 5) + (2 x 6) √

√

RL = 6,25 N √ (6)

2.1.2 Bending moments at:

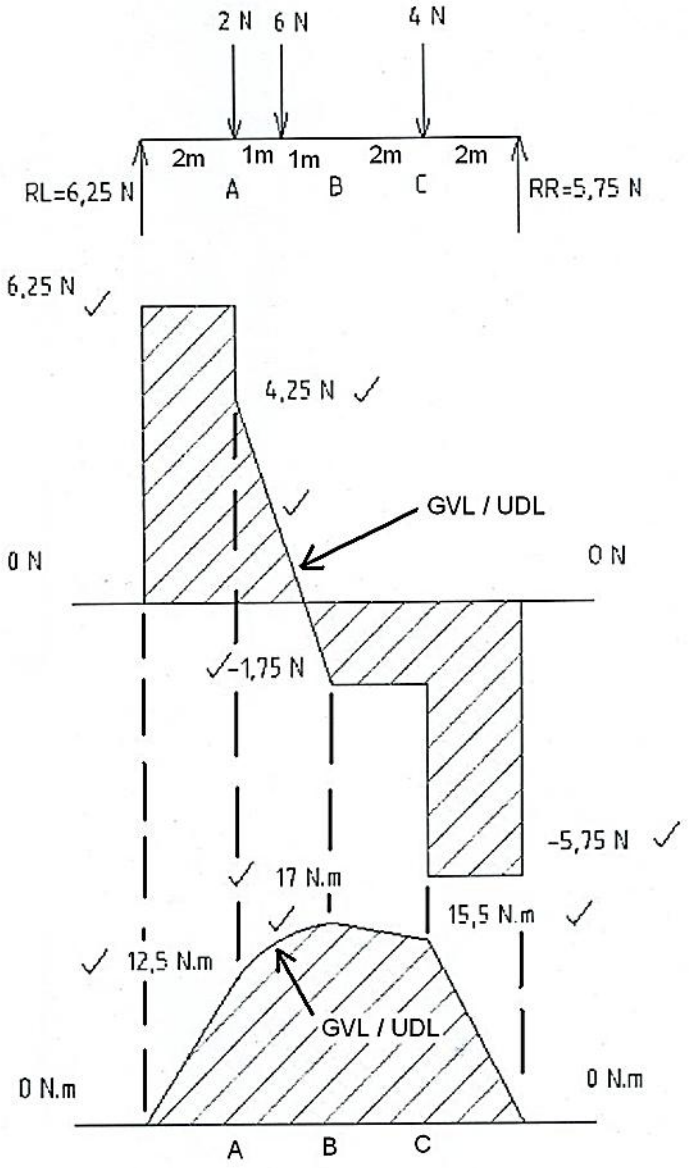
A: (6,25 x 2) – (2 x 0) = 12,5 Nm √

B: (6,25 x 4) – (2 x 2) – (6 x 1) = 15 Nm √

C: (6,25 x 6) – (2 x 4) – (6 x 3) = 11,5 Nm √ (3)

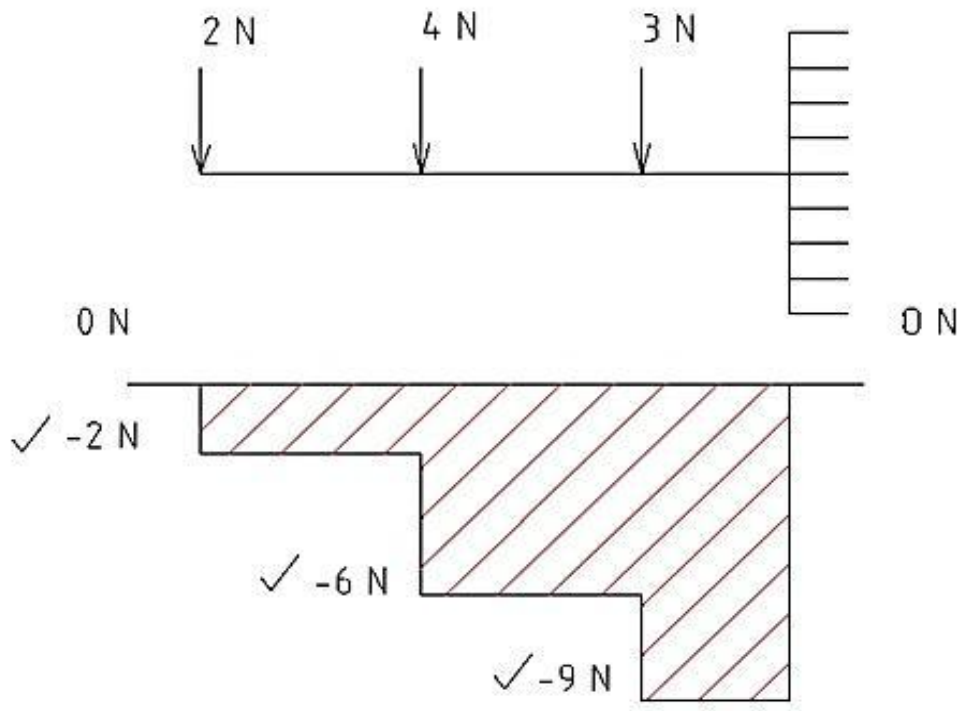
2.1.3 (5)

2.1.4


2 N
6 N
4 N
2m
1m
1m
2m
2m
RL=6,25 N
A
B
C
RR=5,75 N
6,25 N
4,25 N
GVL / UDL
0 N
0 N
-1,75 N
-5,75 N
17 N.m
15,5 N.m
12,5 N.m
GVL / UDL
0 N.m
0 N.m
A
B
C

(4)

2.2



(3)

2.3 A Bevel gear / mitre gears / conical gear √ (Any 1 x 1) (1)
B Spur gear √ (1)
C Double helical gears / herringbone gears √ (1)
D Rack and pinion √ (1)

2.4
- A – Crest √
- B – Pitch √
- C – Root √
- D – Thread angle √
- E – Minor diameter √
- F – Pitch diameter √
- G – Major diameter √
- H – Helix angle √ (8)

2.5 1. mechanical – positive contact, friction type, over-running √
2. hydraulic √
3. electrical √ (3)

2.6 The flywheel √ (1)

2.7 Second-class lever √ (1)

2.8
- The cam √
- The follower √
- The frame √ (3)

2.9 A Piston / Cylinder √
B Air receiver / tank √
C Compressor √ (3)

2.10 Anti-lock brake system √ (1)

2.11
- Regulating pressure in the circuit. √
- Directing the hydraulic fluid and compressed air into lines or into specific directions. √
- Determine the amount of fluid and compressed air that will flow in different parts of the circuit. √ (3)

2.12
- The injector just behind the intake valve. √
- The injector in the combustion chamber. √ (2)

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QUESTION 3: TOOLS AND EQUIPMENT

(Learning Outcome 3: Assessment Standard 2)

3.1 3.1.1 Outside micrometre √ (1)

3.1.2
1. Anvil √
2. Spindle √
3. Lock nut / spindle lock √
4. Barrel √
5. Thimble √
6. Ratchet √
7. U-frame √ (7)

3.2 3.2.1 12, 00
0, 86 √
12, 86 mm √ (2)

3.2.2
1. Length measurements can be taken. √
2. Depth measurements can be taken. √
3. Inside measurements can be taken. √
4. The main scale is longer than that of the micrometre.
5. The vernier can move quicker (than the micrometre) from one measurement to another. (3)

3.3 "Die nut" √ (looks like a nut hexagon) (1)

3.4 N.m. (Newton meter) √ (1)

3.5
1. cylinder head bolts or nuts √
2. main or big-end bearings bolts or nuts √
3. front wheel bearings nuts √
4. rear axle assemblies √
5. bolts and nuts on automatic gearboxes √ (5)

[20]

QUESTION 4: MATERIALS

(Learning Outcome 3: Assessment Standard 3)

4.1
- It is the controlled heating and cooling of metals √
- in their solid state so √
- as to change their properties. √ (3)

4.2
- Elastic hardness √
- Resistance to abrasion √ (2)

4.3

	Processes	**Property**	**Media**	
4.3.1	Hardening	Produce a fine grain structure which is very hard √	Water, brine or oil √	(2)
4.3.2	Tempering	Relieves the strains induced and reduce brittleness √	Water, brine, air or oil √	(2)
4.3.3	Annealing	To make the material ductile refine grain structure and reduce brittleness. To soften the material for machining √	Sand, ashes, charcoal, lime or furnace cooling √	(2)
4.3.4	Normalising	To relieve the internal stresses produced by machining, forging or welding √	Cooling it down in still air √	(2)

4.4
- Remember safety – eye protection √
- Give a light blow of equal force on each of the two specimens with the centre punch and hammer. √
- By visual observation the deeper hole – soft metal. √
- By visual observation the shallow hole – harder metal. √
- By sound – the softer metal dull sound bigger hole – the harder metal clearer sound smaller hole. √ (5)

4.5
- A – Light straw √
- B – 2 600 √ (2)

[20]

QUESTION 5: MANUFACTURING PROCESS, CONSTRUCTION AND SAFETY

(Learning Outcome 3: Assessment Standards 1, 4 and 5)

5.1
- Choose the correctly sharpened drill for the type of work and the material you are going to drill. √
- Do not leave the chuck key in the chuck when you are not at the machine. √
- Never leave the machine running if unattended. √
- Clamp work piece securely to the table and do not hold it by hand. √
- Never try to stop the work piece by hand if it slips from the clamp. √
- Do not force a drill into the work piece.
- Use a brush/wooden rod to remove chips from the drill.
- Be careful that your clothes do not get caught in the drill when reaching around.
- A drill should run at the correct speed for the job. (Any 5 x 1) (5)

5.2
- See that all guards are in place. √
- Ensure that no oil or grease is on the floor. √
- Select the correct blade for the material to be cut. √
- When changing blades ensure that machine is switched off at the mains. √
- When replacing blade, do it gently.
- Do not adjust guides whilst machine is running.
- Clamp material properly.
- Support long pieces of material at the end.
- Always stop machine if you leave it unattended. (Any 4 x 1) (4)

5.3
- Make sure that all guards are in place. √
- Do not wear loose clothing. √
- Keep any waste or rags away from rotating parts. √
- Check that there is no oil or grease on the floor. √
- Do not leave spanners or keys on rotary parts.
- Never apply a spanner to revolving work.
- Always clamp work piece safely and firmly.
- Do not use your hands to remove cuttings while machine is in motion.
- Never adjust the cutting tool while a machine is running.
- Resist the habit of leaning on machinery.
- Do not attempt to stop a machine by placing your hand on the chuck.
- Give attention to cutting-fluid control before switching on a machine. (Any 4 x 1) (4)

5.4 First: clean the joining surfaces mechanically. √
Secondly: then coated with a borax flux that cleans the metal chemically. √ (2)

5.5 5.5.1
- Facing √
- Parallel turning √
- Drilling √
- Boring √
- Taper-turning √
- Screw-thread-cutting
- Parting
- Knurling (Any 5 x 1) (5)

5.5.2
- A – Speed selection √
- B – Crosslide √
- C – Compound slide √
- D – Tailstock √
- E – Emergency/foot stop √ (5)

5.6
- The cutting tool must be sharp. √
- The profile of the cutting tool must be correct. √
- Cutting tool must be clamped rigidly in the tool holder. √
- The lathe must be rigid. √
- If used in lathe, the cutting tool must be set at the correct height.
- The cutting tool must not have too much overhang. (Any 4 x 1) (4)

5.7 5.7.1 Weld all round √

5.7.2 Site weld √ (2)

5.8 5.8.1 Pa (Pascal) √ (1)

5.8.2 m^2 (square meter) √ (1)

5.8.3 m/s (meter per second) √ (1)

5.8.4 7 000 meter √ (1)

5.8.5 Revolutions Per Minute √ (1)

5.9 5.9.1
1. Make sure about correct personal safety equipment. √
2. Open the gas main √
3. Set the regulators √
4. Purge the system √
5. Ignite the acetylene gas (flint-spark lighter) √
6. Adjust the welding flame √ (6)

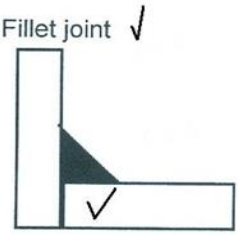
5.9.2 The acetylene cylinder √ (1)

5.9.3 The opening of the cylinder valve briefly √ to blow out any dust and debris. √ (1)

5.10 5.10.1

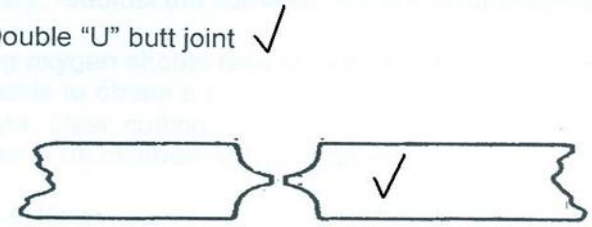
(2)

5.10.2



(2)

5.10.3



(2)

5 **[50]**

QUESTION 6: PUMPS AND MAINTENANCE

(Learning Outcome 3: Assessment Standards 7 and 9)

6.1 6.1.1 It is to reduce friction. √ (1)

6.1.2 It is the force that resists the movement of one object against another. √ (1)

6.2 6.2.1
- OIL LEAK √
- Oil level becomes too low; loss in oil pressure to transport the oil to e.g. bearing. √

OR

- TOO MUCH OIL
- Oil level too high; too much pressure can damage the oil seals. (2)

6.2.2
- LEAK IN COOLING SYSTEM √
- Radiator, radiator hoses head gasket leaking √

OR

- MECHANICAL FAILURE
- Faulty water pump, broken fan belt
- ELECTRONIC FAILURE
- Temperature sending unit indicate wrong/faulty reading. (2)

6.3 6.3.1 It is the oil's resistance to flow. √ (1)

6.3.2 It is the ability to cling to a surface. √ (1)

6.3.3 Society of Automotive Engineers √ (1)

6.4 6.4.1
- By adding small mass pieces. √
- Material can be removed by drilling. √
- Material can be removed by grinding. (2)

6.4.2 A CAMBER WEAR-PATTERN √
Camber too far positive – wear on outside. √ (2)

B SAW-TOOTH WEAR PATTERN √
Too much toe-out – sharp edges pointing to outside. √ (2)

6.5
1. Inlet valve, also called admission valve √
2. Outlet valve, also called discharge valve √
3. Plunger or a piston √ (3)

6.6
- Worn external packing √
- Worn internal packing √
- A strainer exposed above the fluid level √
- A faulty foot valve √
- Faulty or loose flanges or joints √
- A faulty or weak seat or spring of a valve √ (6)

6.7
1. Hub √
2. Bearing shaft assembly √
3. Housing √
4. Seal √
5. Seat √
6. Impeller √ (6)

6.8
1. Centrifugal pumps are more compact. √
2. The initial cost is relatively low. √
3. Maintenance cost is low due to rotation motion of parts. √
4. Centrifugal pumps are adaptable. √
5. The construction is simple and reliable.
6. It works at high speed and therefore connects directly to the motor.
7. No water hammer and shocks.
8. Delivery can be adjusted from no flow to full flow without switching the pump off.
9. Centrifugal pumps do not have moving valves or sensitive parts. (4)

6.9
1. Inlet port √
2. Outlet port √
3. Rotor √
4. Vane √ (4)

6.10
1. Regulates the oil pressure at all engine revolutions. √
2. It relieves excess oil into the sump. √ (2)

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TOTAL: 200