



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION/ NATIONAL SENIOR CERTIFICATE EXAMINATION

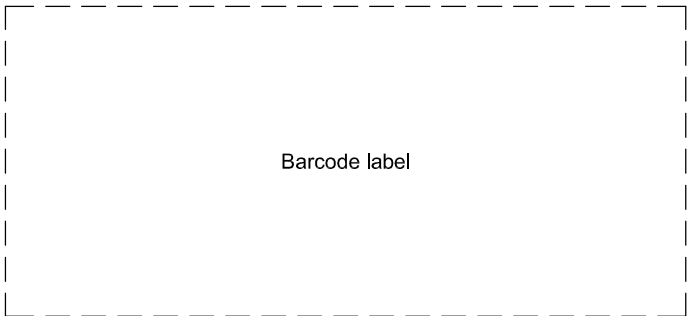
ENGINEERING GRAPHICS AND DESIGN P2

2023

MARKS: 100

TIME: 3 hours

This question paper consists of 6 pages.



Barcode label

INSTRUCTIONS AND INFORMATION

1. This question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings are in third-angle orthographic projection, unless otherwise stated.
4. ALL drawings must be prepared using pencil and instruments, unless otherwise stated.
5. ALL answers must be drawn accurately and neatly.
6. ALL the questions must be answered on the QUESTION PAPER, as instructed.
7. ALL the pages, irrespective of whether the question was attempted or not, must be re-stapled in numerical sequence in the TOP LEFT-HAND CORNER ONLY.
8. Time management is essential in order to complete all the questions.
9. Print your examination number in the block provided on every page.
10. Any details or dimensions not given must be assumed in good proportion.

FOR OFFICIAL USE ONLY											
QUESTION	MARKS OBTAINED			$\frac{1}{2}$	SIGN	MODERATED			$\frac{1}{2}$	SIGN	RE-MARKING
1											
2											
3											
4											
TOTAL											
	2	0	0			2	0	0			2 0 0

FINAL CONVERTED MARK	CHECKED BY
100	

COMPLETE THE FOLLOWING:
CENTRE NUMBER
CENTRE NUMBER
EXAMINATION NUMBER
EXAMINATION NUMBER

PARTS LIST			
	PART	QUANTITY	MATERIAL
1	RULER	1	STAINLESS STEEL
2	CENTRE FINDER	1	CAST ALUMINIUM
3	SQUARE	1	CAST ALUMINIUM
4	LOCK SCREW	2	MILD STEEL
5	LOCK NUT	2	BRASS
6	SPRING	2	SPRING STEEL
7	SCRIBER	1	TOOL STEEL
8	SPIRIT LEVEL	1	GLASS
9	SPIRIT LEVEL CAP	1	BRASS

FILE NAME: PTSD-4Q2

DRAWING No. 058

COMMISSIONED BY:
PRECISION TOOLS,
HUBERT AVE,
KIMBERLEY

MINNIES DRAUGHTING CC
68 KEYSER LANE, NIEUWOUDTVILLE
5161

TITLE:
COMBINATION SQUARE

RULER ACCURATE AT 20 °C

SCALE 1 : 3

DRAWING PROGRAMME: AUTOCAD 2022

www.minniesdraw.co.za
045 123 4567

ALL UNSPECIFIED RADII
ARE 3 mm.

TOLERANCE: +0.025
-0.05

ALL DIMENSIONS ARE IN MILLIMETRES.

QUANTITY: 1500 COMBINATION SQUARES

DRAWN BY: TORIQUE
CHECKED BY: LISA
APPROVED BY: ZAK

DATE: 2022-05-21
DATE: 2022-05-25
DATE: 2022-05-27

QUESTION 1: ANALYTICAL (MECHANICAL)

Given:
Four views of a combination square assembly, detailed views of six of the parts, a parts list, a title block and a table of questions. The drawings are not presented to the indicated scale.

Instructions:
Complete the table below by neatly answering the questions, which refer to the accompanying drawings, the title block and mechanical content.

QUESTIONS		ANSWERS		
1	Who checked the drawing?		1	
2	What is indicated by the number 058?		1	
3	What is the title of the drawing?		1	
4	Who is the client?		1	
5	At what temperature is the ruler accurate?		1	
6	From what material is the spirit level manufactured?		1	
7	How many lock nuts are required for the full order?		1	
8	What orthographic projection system has been used?		1	
9	What is the complete label (name) for VIEW 2?		1	
10	What type of section is produced by cutting plane R-R?		1	
11	What type of section is indicated at A?		1	
12	What type of section is indicated at B?		1	
13	Determine the complete dimension at: C: D: E:		3	
14	How many surfaces of the combination square assembly must be machined?		1	
15	What is the correct label for VIEW 4?		1	
16	What finish must be applied to the surfaces of the lock nut?		1	
17	With reference to the tolerance, determine the maximum and the minimum dimensions for the dimension at F.		2	
18	On the ruler in VIEW 1 ONLY, add, in neat freehand, the SANS 10111 convention for the interrupted view.		3	
19	With reference to the machining symbol below (QUESTION 19), match the letter on the symbol with the correct label in the column to the right of this question.	DIRECTION OF LAY	1	
		ROUGHNESS VALUE	1	
		PRODUCTION METHOD	1	
		MACHINING ALLOWANCE	1	
20	A quarter of a symmetrical base plate is shown in the block below (ANSWER 20). Complete the view by adding the SANS 10111 convention for symmetry in neat freehand.		3	
TOTAL			30	

QUESTION 19:

ANSWER 20:

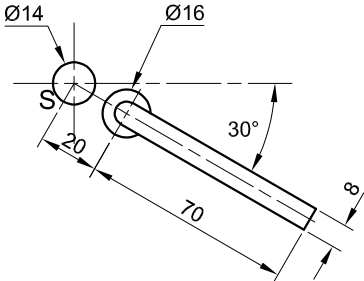
EXAMINATION NUMBER

EXAMINATION NUMBER

2



S⁺



ROLLER-FOLLOWER AND CAMSHAFT DETAIL

QUESTION 2: LOCI (CAM)

Given:

- The detail of a camshaft and a roller-follower at the **minimum** distance from the camshaft centre
- The position of centre point S on the drawing sheet

Specifications:

- The roller-follower reciprocates along the 30° centre line that passes through the centre of the camshaft.
- Rotation = clockwise

Motion:

- The cam imparts the following motion to the roller-follower:
- It moves outward from the given position to the maximum displacement of 66 mm with uniform acceleration and retardation over the first 180°.
 - There is a dwell period for the next 45°.
 - It then moves 32 mm inward with simple harmonic motion over the next 90°.
 - It returns to its original position with uniform motion over the remainder of the rotation.

Instructions:

- Using centre point S on the drawing sheet, draw, to scale 1 : 1, the camshaft and roller-follower at the given minimum distance.
- Draw to a rotational scale of 360° = 120 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Using the given position of the follower as 0°, project and draw the cam profile from the displacement graph.
- Show the direction of rotation of the cam profile with an arrow.
- Label the displacement graph.
- Show ALL construction and projection. [39]

ASSESSMENT CRITERIA					
1	GIVEN + MINIMUM DISTANCE + CL	5			
2	GRAPH CONSTRUCTION + LABELS	6			
3	PLOTTING GRAPH + GRAPH CURVES	9 1/2			
4	CAM CONSTRUCTION + ARROW	5			
5	PLOTTING + CAM PROFILE	13 1/2			
PENALTIES (-)					
TOTAL		39			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3

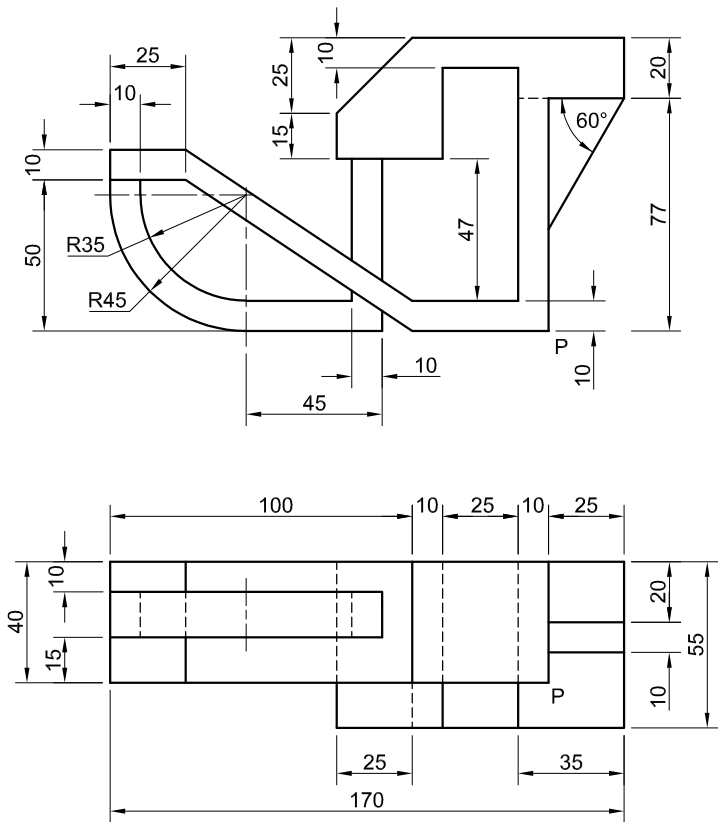


QUESTION 3: ISOMETRIC DRAWING

- Given:**
- The front view and top view of a sliding guide
 - The position of point P on the drawing sheet

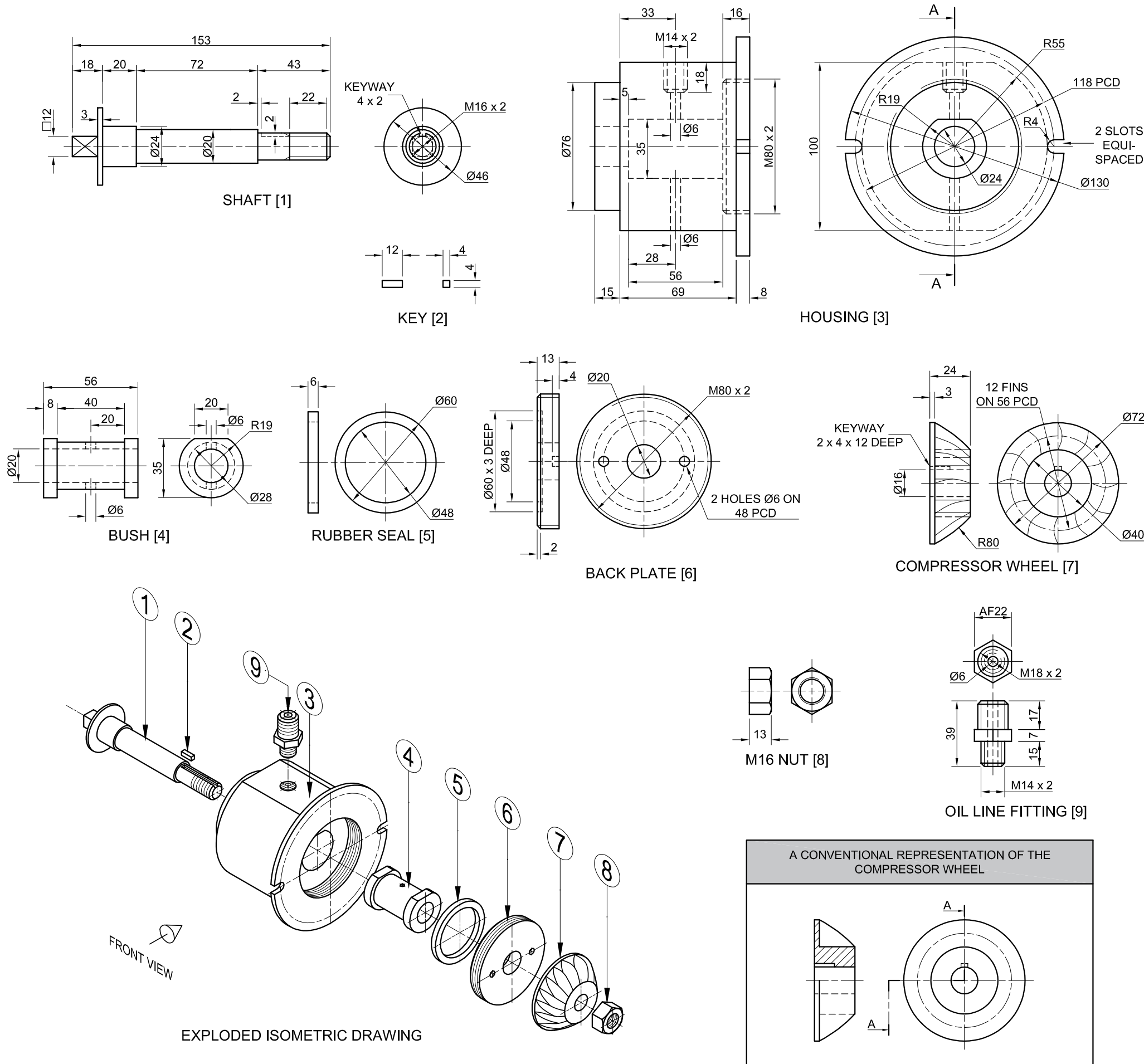
Instructions:
Using scale 1 : 1, convert the orthographic views of the sliding guide into an isometric drawing.

- Use P as the starting and lowest point of the drawing.
 - Show ALL construction.
 - NO hidden detail is required.
- [38]



P

ASSESSMENT CRITERIA				
1	PLACING + AUX. VIEW	1 1/2		
2	BASE	18 1/2		
3	WEB	2 1/2		
4	CIRCLE + CENTRE LINES + BRACE	15 1/2		
PENALTIES (-)				
TOTAL		38		
EXAMINATION NUMBER				
EXAMINATION NUMBER				
EXAMINATION NUMBER				4



QUESTION 4: MECHANICAL ASSEMBLY

- Given:**
- The exploded isometric drawing of the parts of a turbo core assembly, showing the position of each part relative to all the others
 - Orthographic views of each of the parts of the turbo core assembly
 - A conventional representation of the compressor wheel (part 7)

- Instructions:**
- Answer this question on page 6.
 - Draw, to scale 1 : 1 and in third-angle orthographic projection, the following views of the assembled parts of the turbo core assembly:
 - 4.1 A sectional front view** on cutting plane A-A, as seen from the direction of the arrow on the exploded isometric drawing. The cutting plane is shown on the right view of the housing (part 3).
 - 4.2 The right view**

- NOTE:**
- Planning is essential.
 - ALL drawings must comply with the SANS 10111 guidelines.
 - The convention of symmetry may NOT be applied.
 - Show THREE faces of the M16 nut (part 8) in the front view.
 - Draw the compressor wheel (part 7) as a conventional representation.
 - NO hidden detail is required.

[93]

PARTS LIST			
PART		QUANTITY	MATERIAL
1	SHAFT	1	STAINLESS STEEL
2	KEY	1	MILD STEEL
3	HOUSING	1	CAST IRON
4	BUSH	1	BRASS
5	RUBBER SEAL	1	RUBBER
6	BACK PLATE	1	ALUMINIUM
7	COMPRESSOR WHEEL	1	ALUMINIUM ALLOY
8	M16 NUT	1	MILD STEEL
9	OIL LINE FITTING	1	MILD STEEL

JVBW
ENGINEERING CC

7 POWER AVE
CORON PARK
www.speedy.co.za
091 345 6147

TURBO CORE

ALL DIMENSIONS ARE IN MILLIMETRES.

5



FOR OFFICIAL USE ONLY	
INCORRECT ORTHOGRAPHIC PROJECTION	
INCORRECT OVERALL SCALE	
INCORRECT HATCHING	
PARTS NOT ASSEMBLED	
TOTAL PENALTIES (-)	

ASSESSMENT CRITERIA					
RIGHT VIEW					
		POSSIBLE	OBTAINED	SIGN	MODERATED
1	HOUSING + SHAFT	6 ¹ / ₂			
2	BACK PLATE + COMPRESSOR WHEEL	3			
3	M16 NUT	2 ¹ / ₂			
4	OIL LINE FITTING	2 ¹ / ₂			
SUBTOTAL		14 ¹ / ₂			
SECTIONAL FRONT VIEW					
1	SHAFT	12 ¹ / ₂			
2	KEY	2			
3	HOUSING	18			
4	BUSH	5 ¹ / ₂			
5	RUBBER SEAL	4			
6	BACK PLATE	3 ¹ / ₂			
7	COMPRESSOR WHEEL	8			
8	M16 NUT	4			
9	OIL LINE FITTING	10			
SUBTOTAL		67 ¹ / ₂			
GENERAL					
1	CENTRE LINES	3			
2	ASSEMBLY	8			
SUBTOTAL		11			
TOTAL		93			
PENALTIES (-)					
GRAND TOTAL					
EXAMINATION NUMBER					
EXAMINATION NUMBER					6



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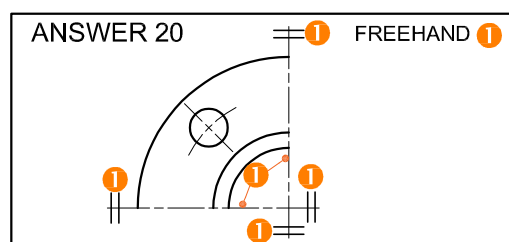
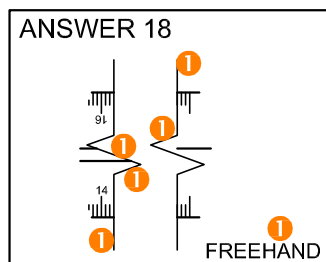
ENGINEERING GRAPHICS AND DESIGN P2

2023

MARKING GUIDELINES

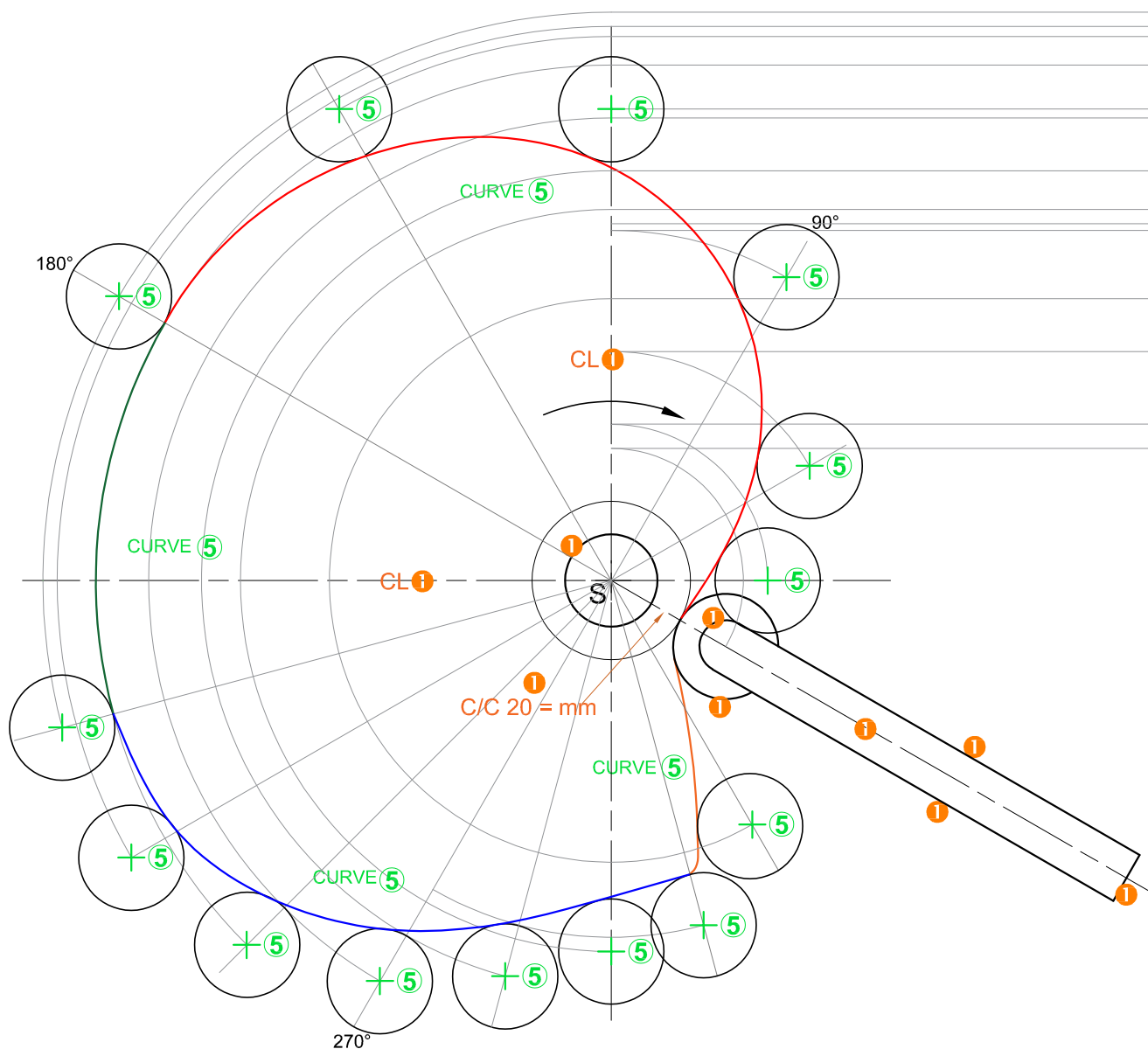
These marking guidelines consist of 7 pages.

ANSWERS		
1	LISA	1
2	DRAWING NUMBER	1
3	COMBINATION SQUARE	1
4	PRECISION TOOLS	1
5	20 °C	1
6	GLASS	1
7	3000	1
8	THIRD ANGLE	1
9	SECTIONAL RIGHT VIEW	1
10	MULTI PLANE / OFF SET	1
11	REVOLVED	1
12	REMOVED	1
13	C: 17 D: 111 E: 14	3
14	9	1
15	DETAIL T	1
16	KNURLING	1
17	103,025 (MAX.) 102,95 (MIN.)	2
18	See below	3
19	L / =	1
	G / N7	1
	J / HONE	1
	H / 2	1
20	See below	3
TOTAL		30



PAPER 2 QUESTION 1
GRADE 12
JUNE 2023
MARKING GUIDELINE

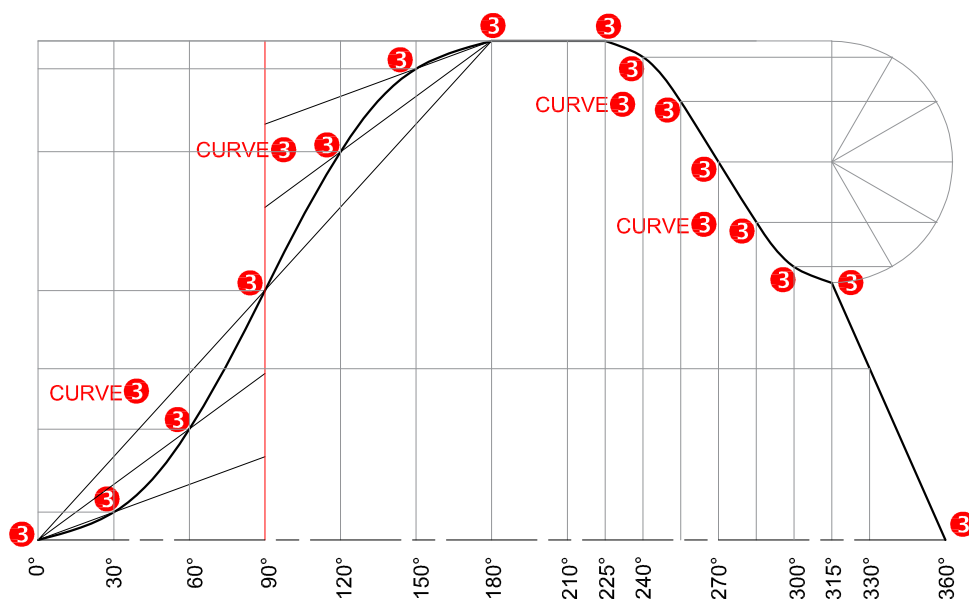
- | | | |
|---|--|------------------------------------|
| - | 14 CENTRE POINTS | 7 |
| - | ROLLERS | 2 |
| - | POINTS OF TANGENCY | 2 |
| - | CURVE TANGENT TO GIVEN FOLLOWER | 0,5 |
| - | CURVE QUALITY ($4 \times \frac{1}{2}$) | 2 |
| | <u>TOTAL</u> | <u>13 $\frac{1}{2}$</u> |



-	PROJECTION / TRANSFERRING FROM GRAPH	1
-	CIRCLE DIVISION	1
-	ARC PROJECTION / TRANSFER	1
-	PLOT DIRECTION (ANTI-CLOCKWISE)	1
-	ARROW (CLOCKWISE)	1
	TOTAL	5

ASSESSMENT CRITERIA		
1	GIVEN + MINIMUM DISTANCE + CL	5
4	CAM CONSTRUCTION + ARROW	5
5	PLOTTING + CAM PROFILE	13 $\frac{1}{2}$
TOTAL		23 $\frac{1}{2}$

Please turn over



DISPLACEMENT GRAPH ②

2. GRAPH CONSTRUCTION

- LENGTH (120) 1
- 12 EQUAL DIVISION 1
- TOTAL 2

2. UNIFORM ACCELERATION + RETARDATION CONSTRUCTION

- VERTICAL DIVISION 0.5
- 1st HALF 0.5
- 2nd HALF 0.5
- TOTAL $1\frac{1}{2}$

2. SIMPLE HARMONIC MOTION CONSTRUCTION

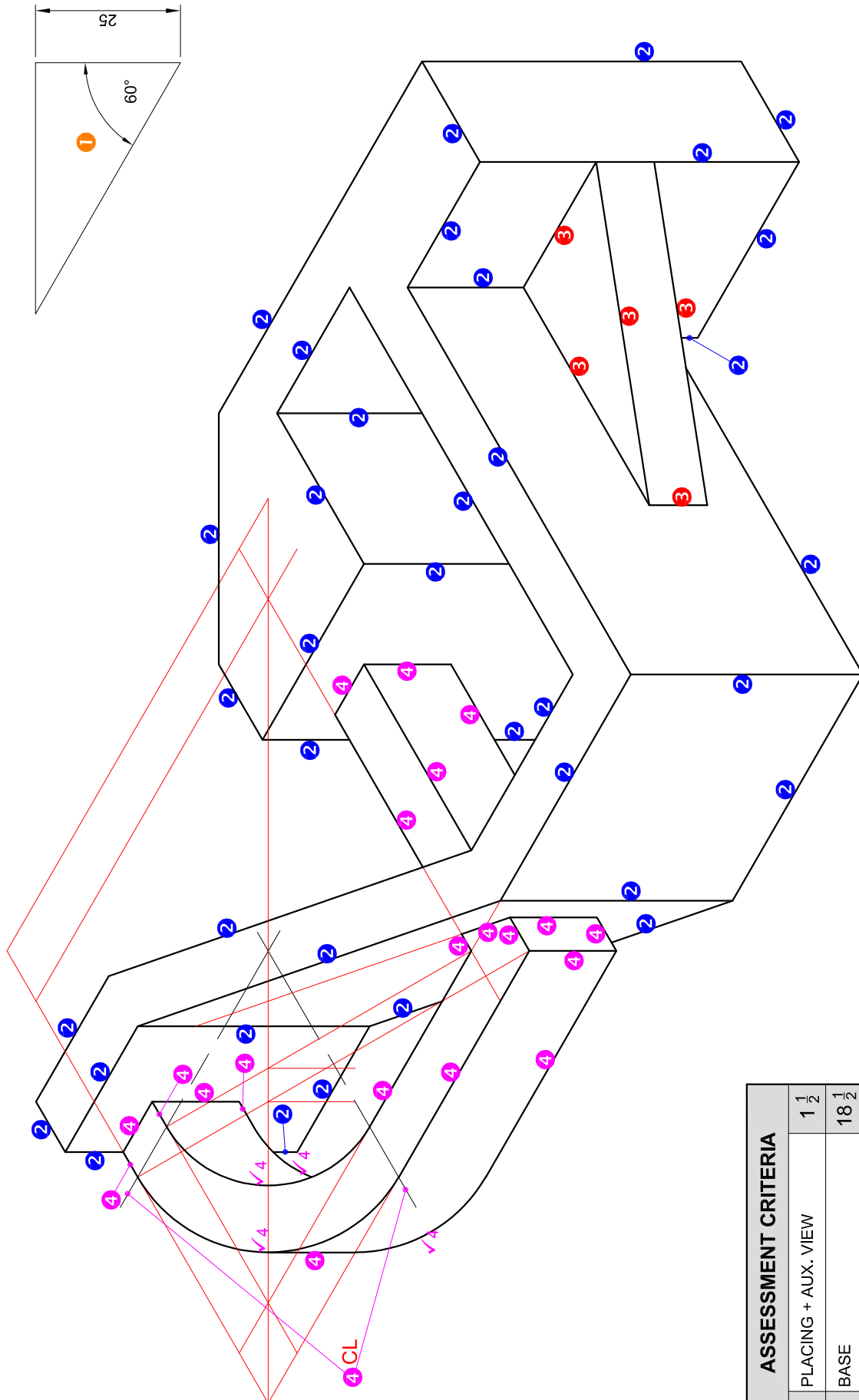
- SEMI CIRCLE 0.5
- CIRCLE DIVISION 0.5
- ADDITIONAL 15° DIVISIONS 0.5
- PROJECTION 0.5
- TOTAL 2

ASSESSMENT CRITERIA

2	GRAPH CONSTRUCTION + LABELS	6
3	PLOTTING GRAPH + GRAPH CURVES	$9\frac{1}{2}$
TOTAL		$15\frac{1}{2}$

PAPER 2 QUESTION 2
GRADE 12
JUNE 2023
MARKING GUIDELINE

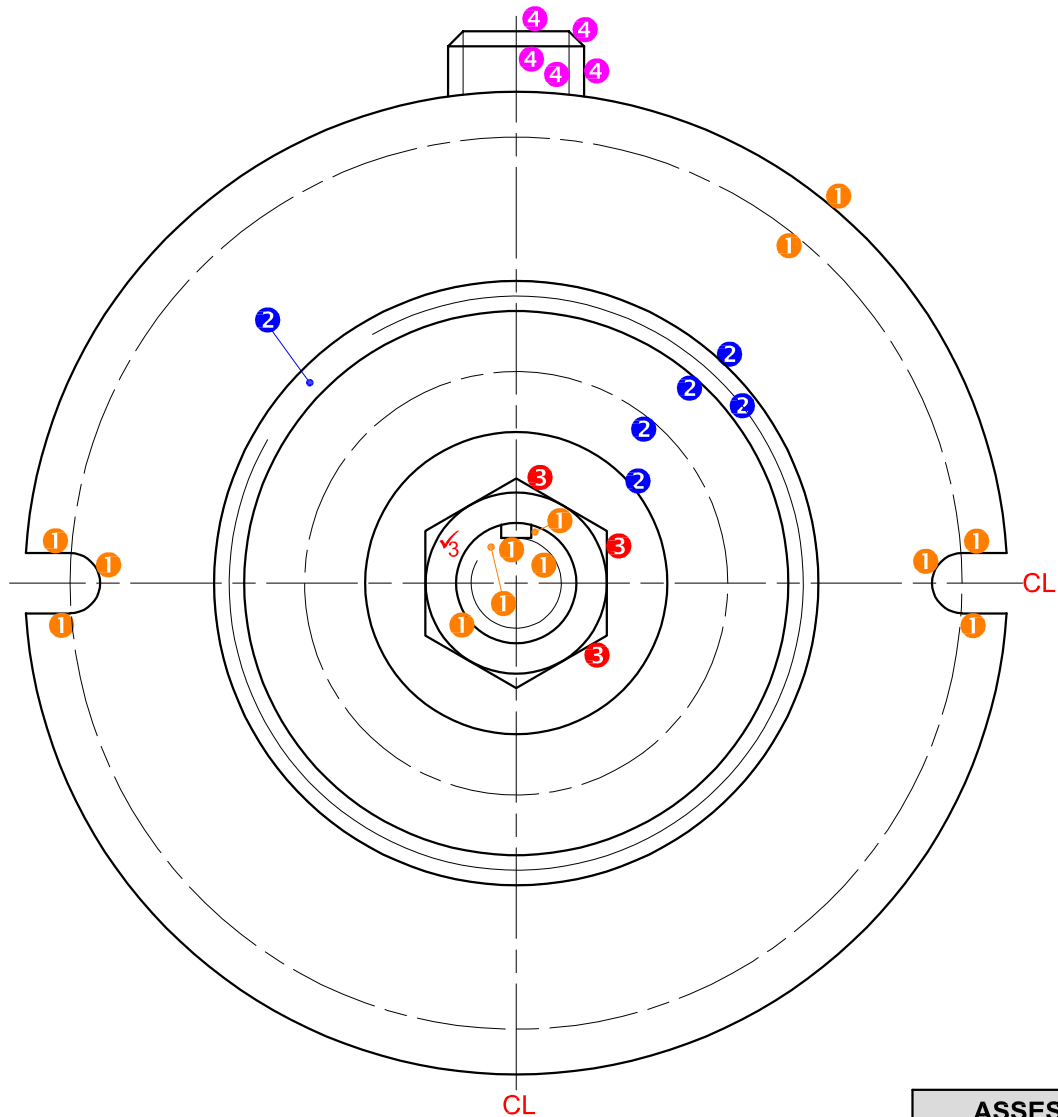
ARC CONSTRUCTION ✓ 4



P ✓ 1 PLACEMENT / ORIENTATION

PAPER 2 QUESTION 3
GRADE 12
JUNE 2023
MARKING GUIDELINE

ASSESSMENT CRITERIA	
1	1 1/2
2	18 1/2
3	2 1/2
4	15 1/2
TOTAL	
38	



1. CENTRE LINES
SANS COMPLIANT
1 - 3 = 1; 4 - 5 = 2

1
2
3

NOTE: THE CONVENTION
AND PCD CLs NOT INCLUDED

2. ASSEMBLY

1 MARK FOR EVERY COMPONENT CORRECTLY
ASSEMBLED (9 PARTS - 1) = 8

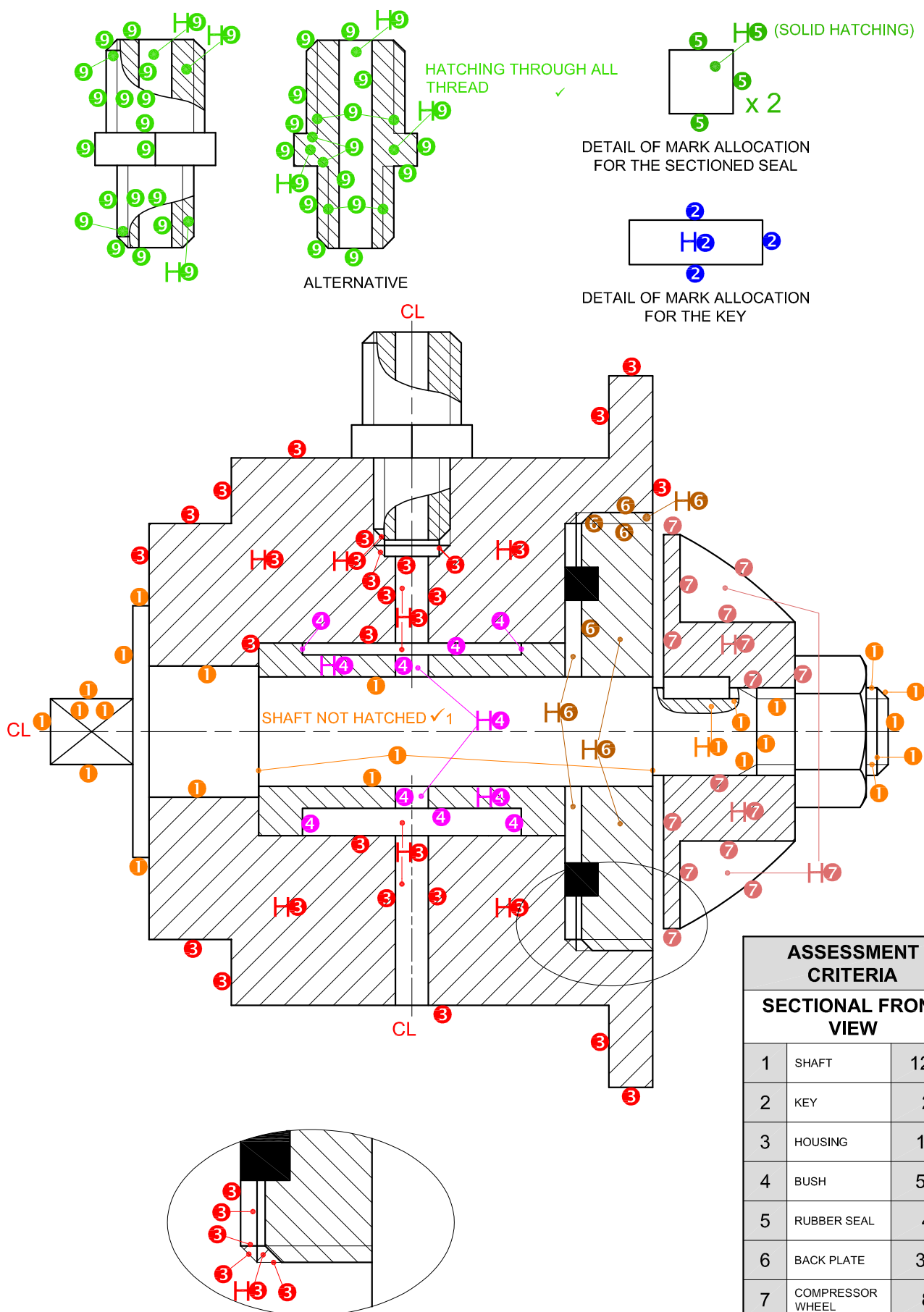
ASSESSMENT CRITERIA		
GENERAL		
1	CENTRE LINES	3
2	ASSEMBLY	8
SUBTOTAL		11

ASSESSMENT CRITERIA

RIGHT VIEW

1	HOUSING + SHAFT	6 $\frac{1}{2}$
2	BACK PLATE + COMPRESSOR WHEEL	3
3	M16 NUT	2 $\frac{1}{2}$
4	OIL LINE FITTING	2 $\frac{1}{2}$
SUBTOTAL		14 $\frac{1}{2}$

PAPER 2 QUESTION 4
GRADE 12
2023
MARKING GUIDELINES



PAPER 2 QUESTION 4
GRADE 12
2023
MARKING GUIDELINES

ASSESSMENT CRITERIA		
SECTIONAL FRONT VIEW		
1	SHAFT	12 $\frac{1}{2}$
2	KEY	2
3	HOUSING	18
4	BUSH	5 $\frac{1}{2}$
5	RUBBER SEAL	4
6	BACK PLATE	3 $\frac{1}{2}$
7	COMPRESSOR WHEEL	8
8	M16 NUT	4
9	OIL LINE FITTING	10
SUBTOTAL		67 $\frac{1}{2}$