



basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

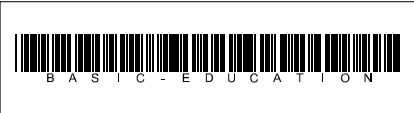
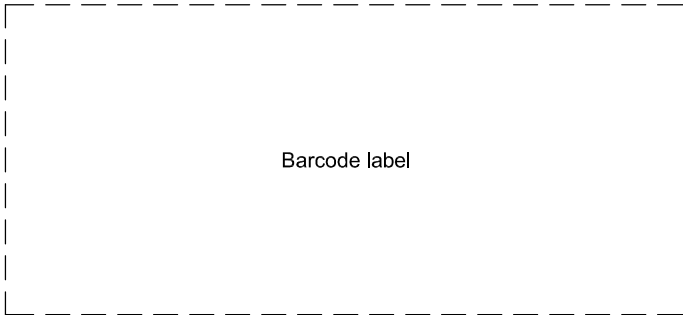
**SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS**

ENGINEERING GRAPHICS AND DESIGN P2
2021

MARKS: 100

TIME: 3 hours

This question paper consists of 6 pages.



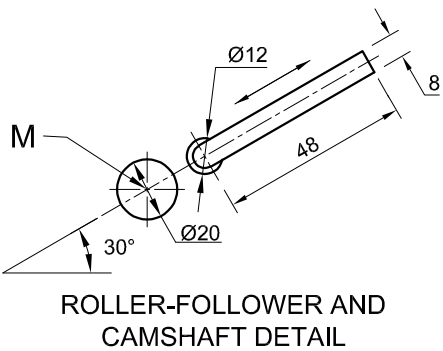
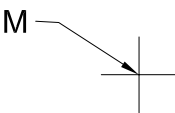
INSTRUCTIONS AND INFORMATION

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			$\frac{1}{2}$	SIGN
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



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 M on the drawing sheet

- Specifications:**
- The roller-follower reciprocates on a 30° centre line that passes through the centre of the camshaft
 - The minimum distance from the centre of the roller of the follower to the centre of the camshaft = 22 mm
 - Rotation = clockwise

- Motion:**
- The cam imparts the following motion to the roller-follower:
- It moves 48 mm outwards from its given position with uniform motion over the first 60°
 - There is a dwell period for the next 45°
 - It moves a further 12 mm outwards with uniform motion over the next 75°
 - It returns to its original position with uniform acceleration and retardation over the remainder of the rotation

- Instructions:**
- Draw, to scale 1 : 1, the camshaft and the roller-follower in the given position.
 - Draw, to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
 - Label the displacement graph and include the rotational scale.
 - Using the given position of the roller-follower as the 0° axis, project and draw the cam profile from the displacement graph.
 - Show the direction of rotation on the cam profile.
 - Show ALL construction and projection. [38]

ASSESSMENT CRITERIA				
1	GIVEN + MINIMUM DISTANCE + CENTRE LINES	5		
2	GRAPH CONSTRUCTION	5 1/2		
3	DISPLACEMENT GRAPH	6		
4	CAM CONSTRUCTION	6		
5	CAM + CURVE QUALITY	15 1/2		
PENALTIES				
TOTAL		38		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



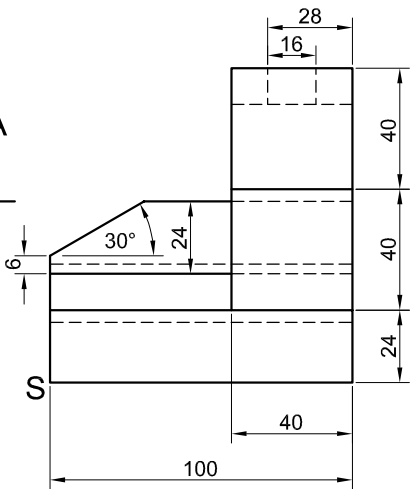
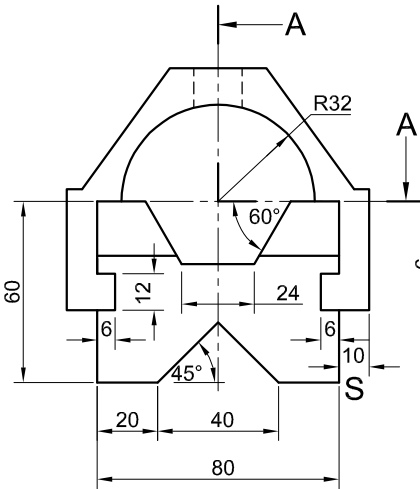
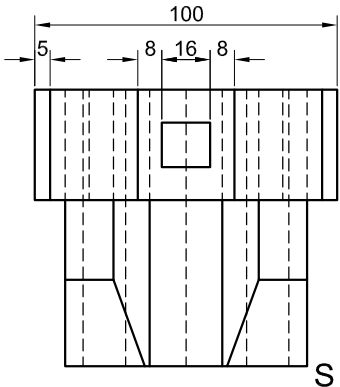
QUESTION 3: ISOMETRIC DRAWING

- Given:**
- The front view, top view and right view of a groove block and slider assembly
 - The position of point S on the drawing sheet

Instructions:
Using scale 1 : 1, convert the orthographic views of the groove block and slider assembly into a sectional isometric drawing on cutting plane A-A.

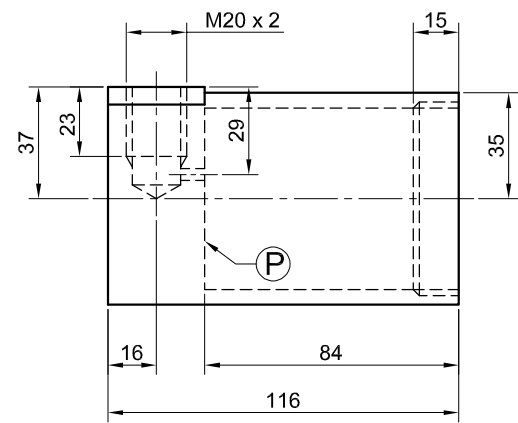
- Make S the lowest point of the drawing.
- Show ALL construction.
- NO hidden detail is required.

[42]

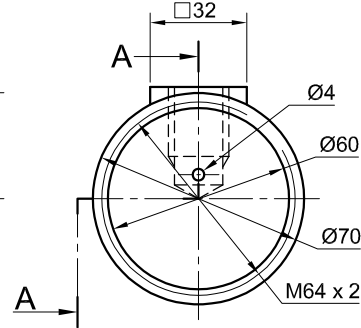


ASSESSMENT CRITERIA				
1	AUX. VIEW + PLACING	2		
2	LOWER PORTION	15		
3	UPPER PORTION	14		
4	SECTION	8		
5	ISO CIRCLES + CIRCLE CONSTR' + CENTRE LINES	3		
PENALTIES				
TOTAL		42		
EXAMINATION NUMBER				
EXAMINATION NUMBER				4

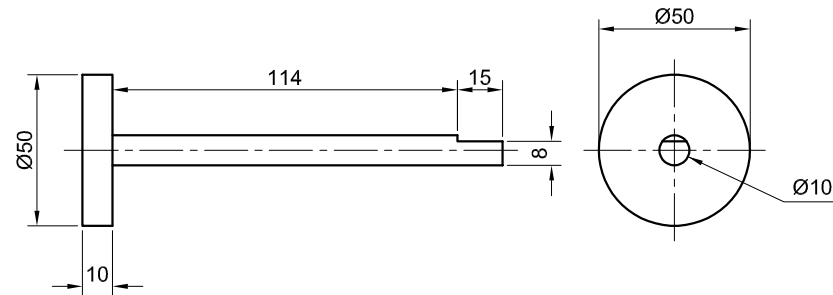
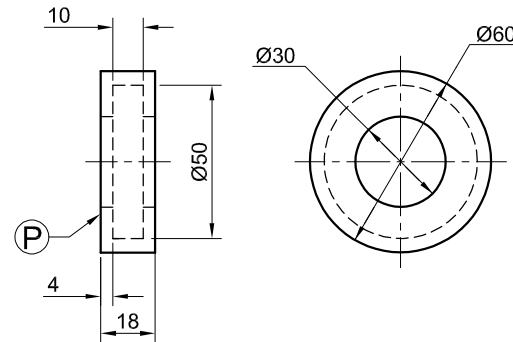




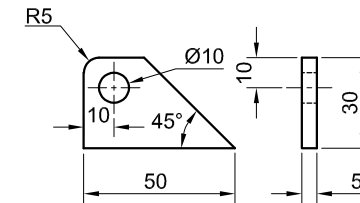
CYLINDER [1]



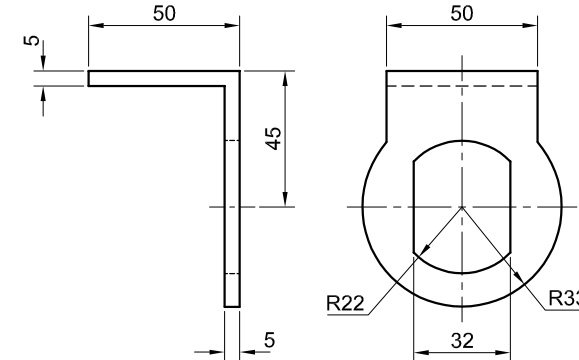
RUBBER SEAL [2]



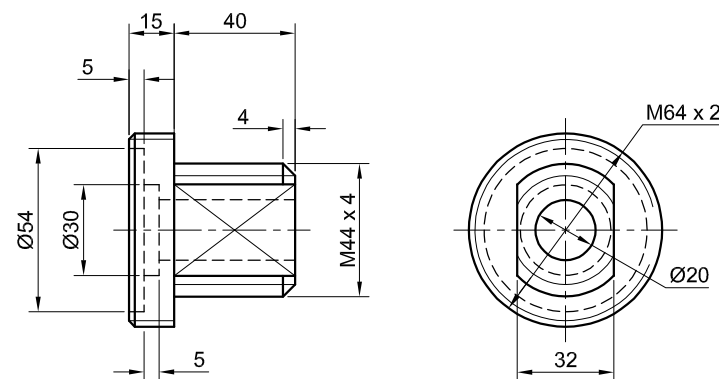
BUSH [4]



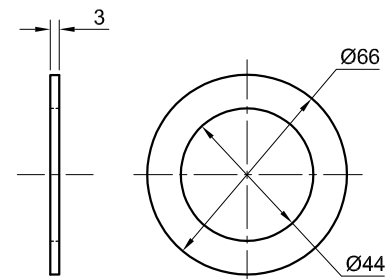
HOOK [6]



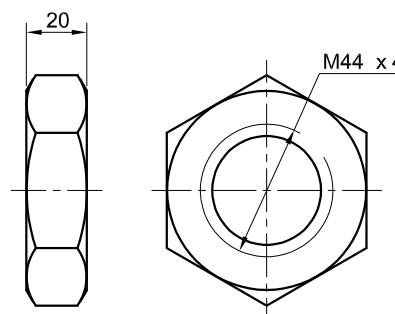
BRACKET [7]



GUIDE [5]



WASHER [8]



M44 NUT [9]

WELDING SYMBOL

QUESTION 4: ASSEMBLY DRAWING

Given:

- The exploded isometric drawing of the parts of a pressure pump assembly, showing the position of each part relative to all the others
- Orthographic views of each of the parts of the pressure pump assembly
- A welding symbol

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 pressure pump assembly:

4.1 A half-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 cylinder (part 1).

4.2 The top view

4.3 The right view

NOTE:

- Planning is essential.
- The drawing must comply with the guidelines as contained in the SANS 10111.
- The convention of symmetry may NOT be applied.
- Place the head of the plunger (part 3) inside the rubber seal (part 2).
- Place surface P on the rubber seal (part 2) against surface P on the inside of the cylinder (part 1).
- Show THREE faces of the M44 nut (part 9) in the front view.
- The hook (part 6) must be welded onto the bracket (part 7). Draw, to the given size, the complete welding symbol in the correct position on the right view.
- NO hidden detail is required.

[90]

PARTS LIST

PART		QUANTITY	MATERIAL
1	CYLINDER	1	ALUMINIUM
2	RUBBER SEAL	1	RUBBER
3	PLUNGER	1	MILD STEEL
4	BUSH	1	BRASS
5	GUIDE	1	ALUMINIUM
6	HOOK	1	MILD STEEL
7	BRACKET	1	MILD STEEL
8	WASHER	1	MILD STEEL
9	M44 NUT	1	MILD STEEL

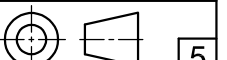
WESTO PUMPS
ENGINEERING (PTY) LTD

102 OAK STREET
DINALEDI PARK 1020
www.westopumps.za

PRESSURE PUMP

ALL DIMENSIONS ARE
IN MILLIMETRES

ALL UNSPECIFIED
RADII ARE 3 mm



5

FRONT VIEW

EXPLODED ISOMETRIC DRAWING





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

ASSESSMENT CRITERIA					
RIGHT VIEW					
		POSSIBLE	OBTAINED	SIGN	MODERATED
1	SHAFT + BUSH	1 1/2			
2	CYLINDER + BRACKET + HOOK	4			
3	M44 NUT + GUIDE	6			
SUBTOTAL		11 1/2			
HALF-SECTIONAL FRONT VIEW					
1	CYLINDER	12			
2	RUBBER SEAL	2 1/2			
3	PLUNGER	5			
4	BUSH	2 1/2			
5	GUIDE	11 1/2			
6	BRACKET + HOOK	6			
7	M44 NUT + WASHER	6 1/2			
SUBTOTAL		46			
TOP VIEW					
1	CYLINDER	5 1/2			
2	BRACKET + HOOK	3 1/2			
3	GUIDE + SHAFT	4 1/2			
4	M44 NUT + WASHER	4			
SUBTOTAL		17 1/2			
GENERAL					
1	CENTRE LINES	3			
2	ASSEMBLY	8			
3	WELDING SYMBOL	4			
SUBTOTAL		15			
TOTAL		90			
PENALTIES (-)					
GRAND TOTAL					
EXAMINATION NUMBER					
EXAMINATION NUMBER					6





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SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

ENGINEERING GRAPHICS AND DESIGN P2

2021

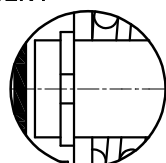
MARKING GUIDELINES

MARKS: 100

These marking guidelines consist of 7 pages.

ANSWERS		
1	REAR DERAILLEUR ASSEMBLY	1
2	SPEED STREET	1
3	3	1
4	MAFIKA	1
5	VBJW031	1
6	SECTIONAL RIGHT VIEW	2
7	See below	1
8	3	1
9	B: R5 C: 16 D: 20 E: 98	4
10	135°	1
11	17	1
12	KNURLING	1
13	ACROSS FLATS	1
14	REVOLVED SECTION	1
15	See below	3
16	ALIGNED SECTION	1
17	1.64	2
18	See below	3
19		3
TOTAL		30

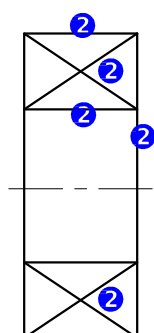
ANSWER 7



DETAIL Z

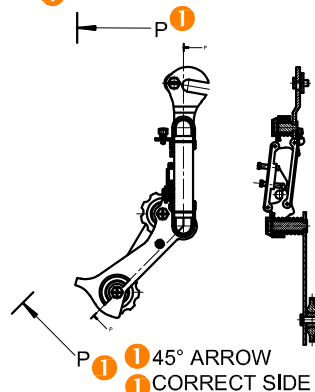
ANSWER 18

2 FREEHAND



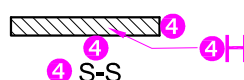
ANSWER 15

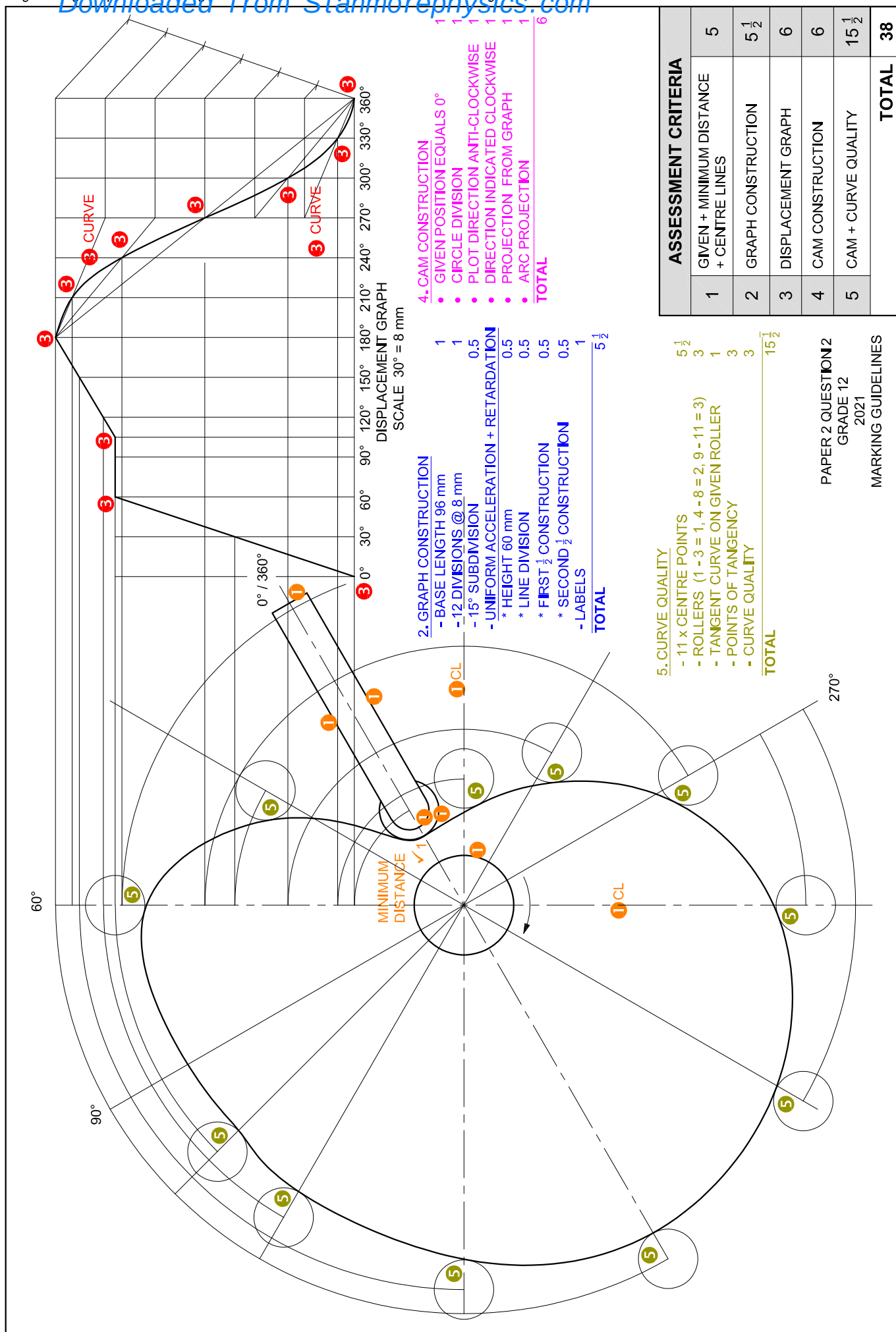
1 0° ARROW
1 CORRECT SIDE

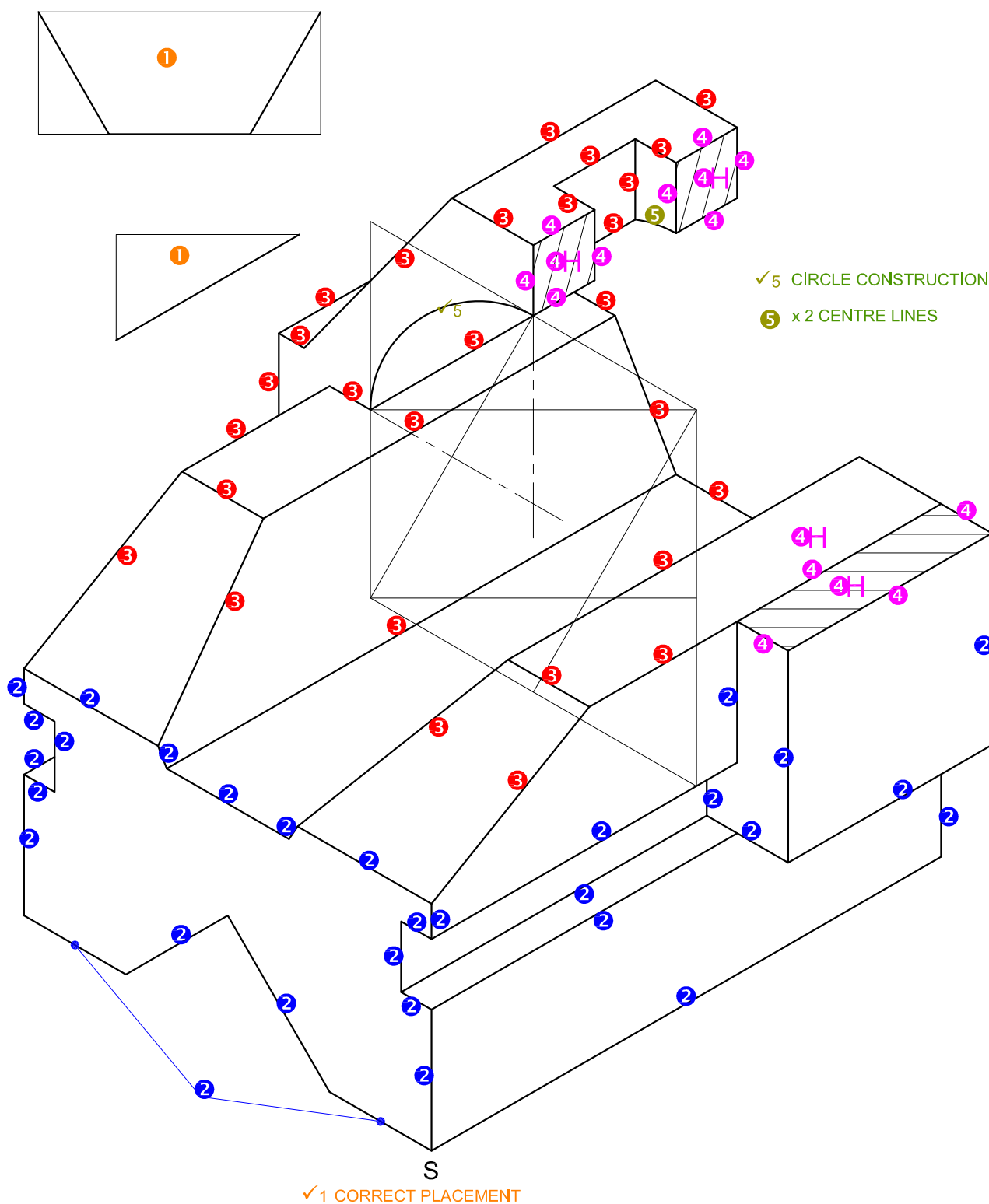


ANSWER 19

4 FREEHAND
4 PROPORTION

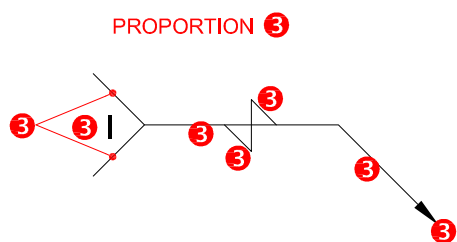




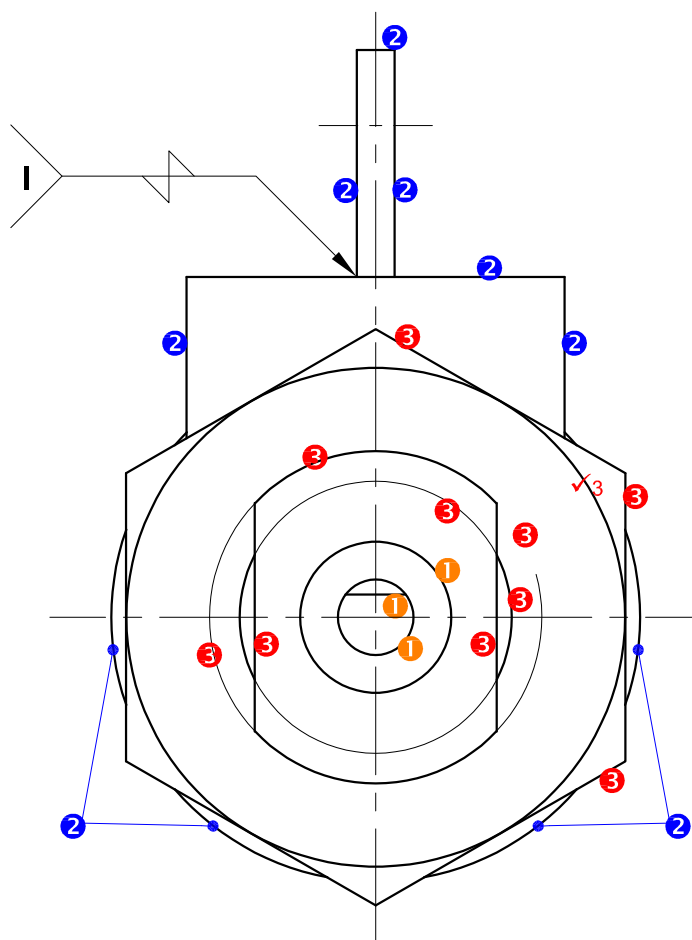
**ASSESSMENT CRITERIA**

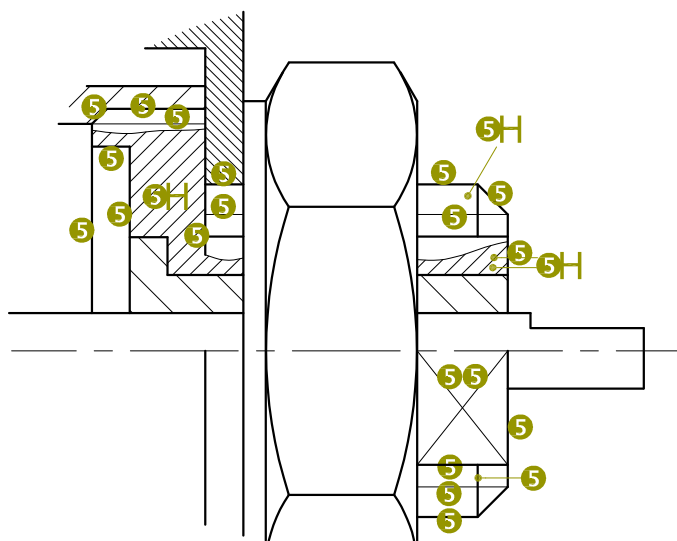
1	AUX. VIEW + PLACING	2
2	LOWER PORTION	15
3	UPPER PORTION	14
4	SECTION	8
5	ISO CIRCLES + CIRCLE CONSTR' + CENTRE LINES	3
TOTAL		42

PAPER 2 QUESTION 3
GRADE 12
2021
MARKING GUIDELINES



RIGHT VIEW		
		POSSIBLE
1	SHAFT + BUSH	1 $\frac{1}{2}$
2	CYLINDER + BRACKET + HOOK	4
3	M44 NUT + GUIDE	6
SUBTOTAL		11 $\frac{1}{2}$

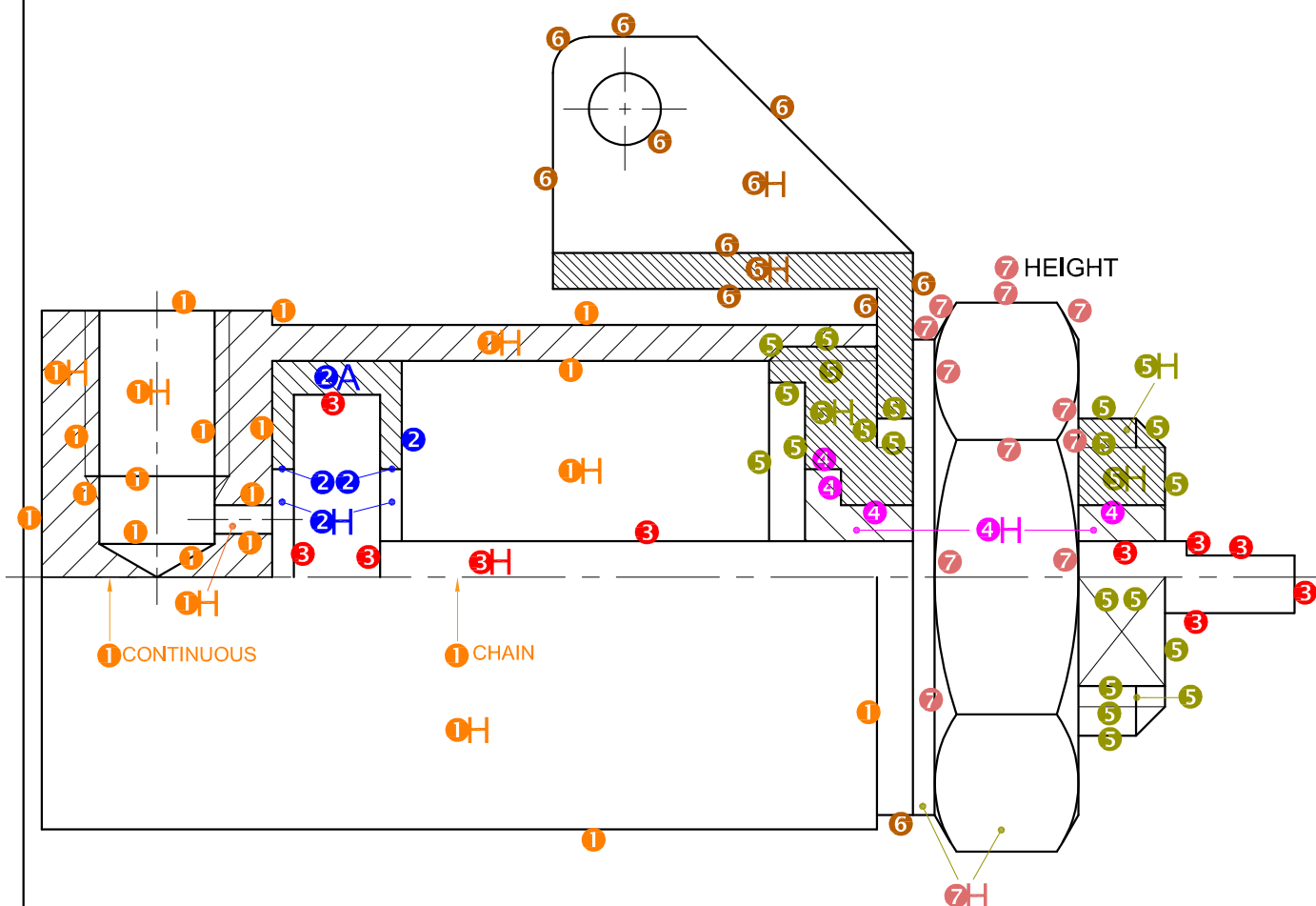




ALTERNATIVE ANSWER
WITH A PART SECTION

HALF-SECTIONAL FRONT VIEW

1	CYLINDER	12
2	RUBBER SEAL	$2\frac{1}{2}$
3	PLUNGER	5
4	BUSH	$2\frac{1}{2}$
5	GUIDE	$11\frac{1}{2}$
6	BRACKET + HOOK	6
7	M44 NUT + WASHER	$6\frac{1}{2}$
SUBTOTAL		46



1. CENTRE LINE MARK ALLOCATION

SANS COMPLIANT (LINE TYPE)

1

11 CENTRE LINES (1 - 2 = 0, 3 - 5 = 1, 6 - 7 = 2)

2

TOTAL**3****2. ASSEMBLY**

1 MARK FOR EVERY

COMPONENT CORRECTLY

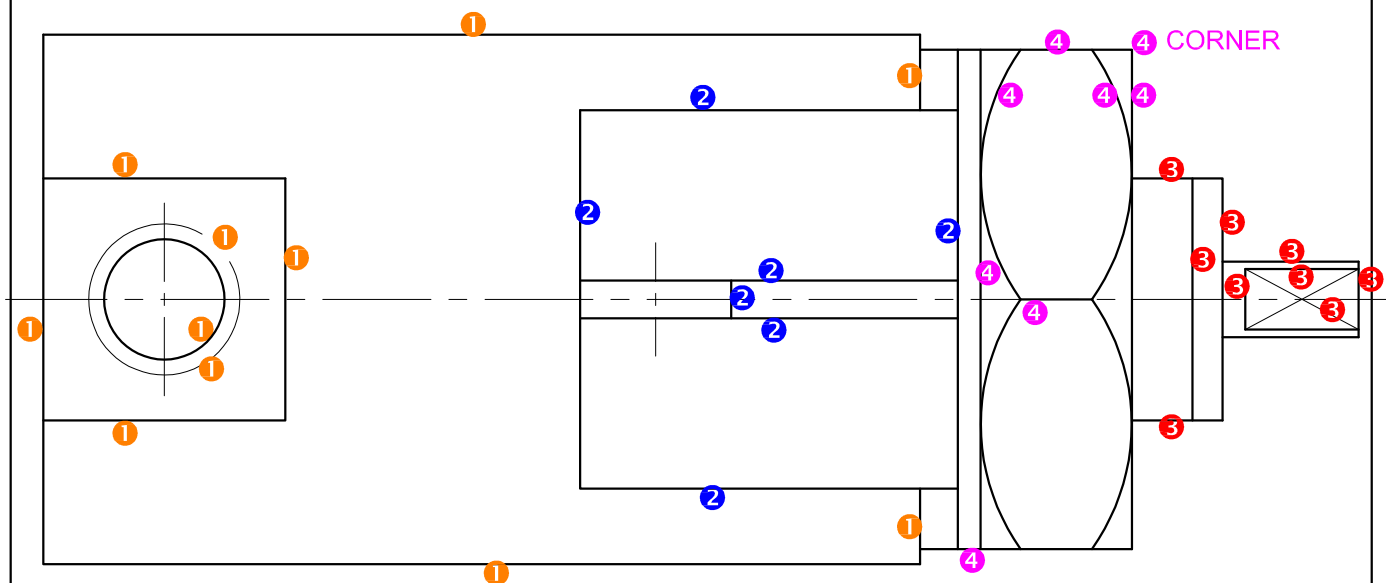
ASSEMBLED (9 PARTS -1) = 8

TOP VIEW

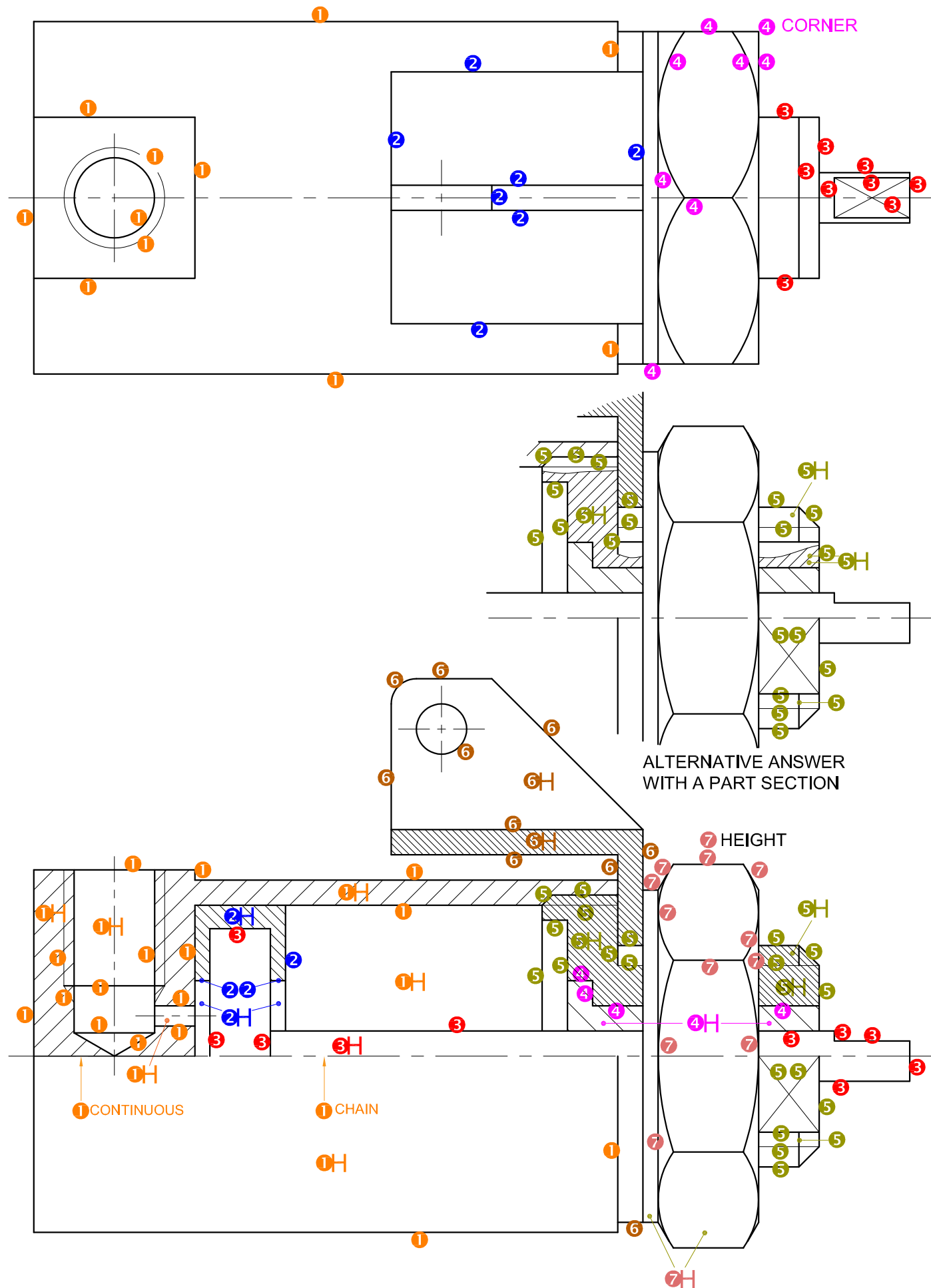
1	CYLINDER	5 $\frac{1}{2}$
2	BRACKET + HOOK	3 $\frac{1}{2}$
3	GUIDE + SHAFT	4 $\frac{1}{2}$
	M44 NUT + WASHER	4

SUBTOTAL17 $\frac{1}{2}$ **GENERAL**

1	CENTRE LINES	3
2	ASSEMBLY	8
3	WELDING SYMBOL	4

SUBTOTAL**15**

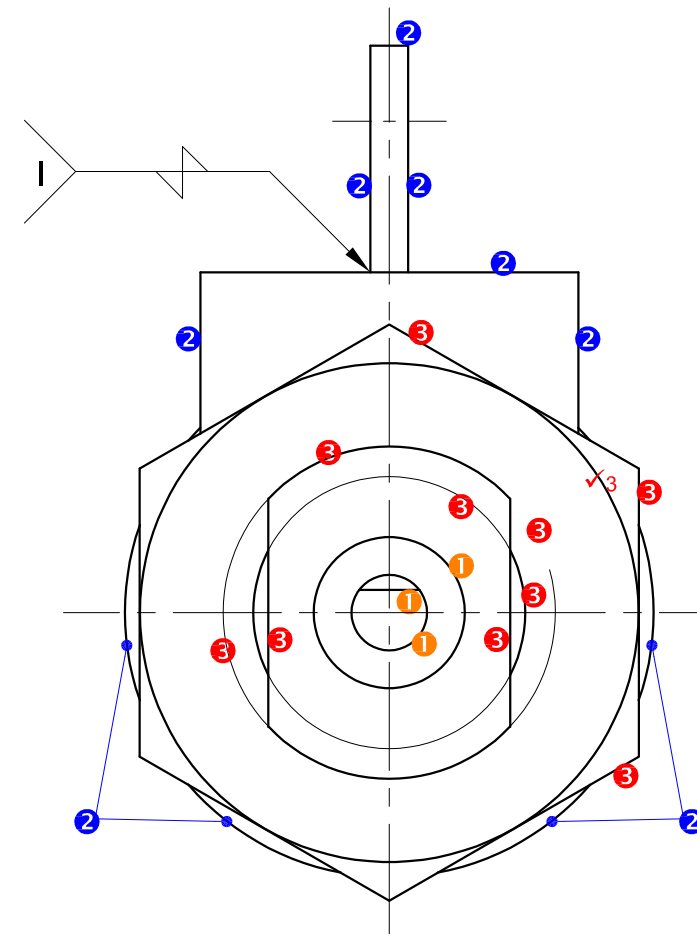
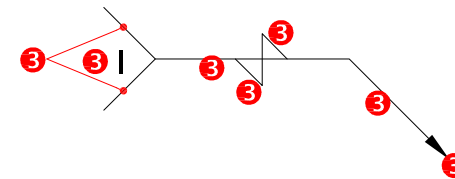
PAPER 2 QUESTION 4
 GRADE 12
 2021
 MARKING GUIDELINE



1. CENTRE LINE MARK ALLOCATION
SANS COMPLIANT (LINE TYPE)
 7 CENTRE LINES (1 - 2 = 0, 3 - 5 = 1, 6 - 7 = 0)
TOTAL

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

PROPORTION 3



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

ASSESSMENT CRITERIA					
RIGHT VIEW					
		POSSIBLE	OBTAINED	SIGN	MODERATED
1	SHAFT + BUSH	1 $\frac{1}{2}$			
2	CYLINDER + BRACKET + HOOK	4			
3	M44 NUT + GUIDE	6			
SUBTOTAL		11 $\frac{1}{2}$			
HALF-SECTIONAL FRONT VIEW					
1	CYLINDER	12			
2	RUBBER SEAL	2 $\frac{1}{2}$			
3	PLUNGER	5			
4	BUSH	2 $\frac{1}{2}$			
5	GUIDE	11 $\frac{1}{2}$			
6	BRACKET + HOOK	6			
7	M44 NUT + WASHER	6 $\frac{1}{2}$			
SUBTOTAL		46			
TOP VIEW					
1	CYLINDER	5 $\frac{1}{2}$			
2	BRACKET + HOOK	3 $\frac{1}{2}$			
3	GUIDE + SHAFT	4 $\frac{1}{2}$			
4	M44 NUT + WASHER	4			
SUBTOTAL		17 $\frac{1}{2}$			
GENERAL					
1	CENTRE LINES	3			
2	ASSEMBLY	8			
3	WELDING SYMBOL	4			
SUBTOTAL		15			
TOTAL		90			
PENALTIES (-)					
GRAND TOTAL					
EXAMINATION NUMBER					
EXAMINATION NUMBER					6