



EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

Home of Examinations and Assessment, Zone 6, Zwelitsha, 5600

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2022 NSC CHIEF MARKER'S REPORT

SUBJECT	ENGINEERING GRAPHICS AND DESIGN		
QUESTION PAPER	1	2	3
DURATION OF QUESTION PAPER	3HRS		
PROVINCE	EASTERN CAPE		
DATES OF MARKING	9 – 21 DECEMBER 2022		

SECTION 1: (General overview of Learner Performance in the question paper as a whole)

The overall performance of the candidates was shocking. In some centres, certain questions were poorly answered or just left out. Simple copy work was poorly done and even left out. The amount of “0” marks for a question has increased quite substantially. In some cases, candidates even score “0” marks in two of the questions, because they did not even attempt the questions.

SECTION 2: Comment on candidates' performance in individual questions

QUESTION 1

- (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The analytical questions were poorly answered, with very few candidates scoring any marks in the middle to higher order questions.
- (b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
- (c) Provide suggestions for improvement in relation to Teaching and Learning
- Teachers must make use of the SANS and DBE approved textbooks to obtain the correct terminology for the subject. Make use of old papers that are available on the internet to learn the different terminologies that the pupils need to understand.
 - Exercises in the reading of drawings must be done to improve the candidate's ability to find and calculate dimensions.
 - Teachers must make use of old examination papers to guide the candidates in how to answer the analytical question.

- Candidates must answer questions correctly, e.g. if the question states that the symbol must be drawn in freehand, then it must be freehand. The opposite is also true; if instruments are required then freehand drawings will not be accepted.
 - Time management is essential to complete all the questions. Learners need to work under strict time frames as to improve their drawing speed.
 - Make use of old mechanical parts that teachers can get from their local automotive repair shops, and use them as examples for their learners to understand the different components and their workings. Disassemble the parts and put them back together so that the learners can see how parts fit together.
 - This is the type of question that you should give to your pupils and they take it home and research the answers. Let the class then decide which answer is the correct one and why.
 - To get candidates to learn where the different views must be placed in third angle orthographic projection, let them print the names of the views on the drawings that they do for CASS.
- (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
- It seems to be that candidates leave question 1 for the end of the session which means that they sometimes run out of time and have to rush through the questions and then make mistakes. Time management is very important when completing the question paper.
 - The responses from candidates indicate that many of them do not understand the terminology and language that is used in the paper. The answers would reflect that they did not understand what was asked, e.g. dimensions become names of parts, etc. The lack of knowledge of technical terminology was a big factor in the inability of the candidates to answer questions.
 - This type of question should be asked in grade 10 to start developing their skills in reading drawings.
 - With the exception of a few questions the majority of questions have been asked in previous papers. This shows that teachers do not consult previous papers when planning their lessons.
 - Learners are not interested in learning the basics that is taught from Grade 10.

QUESTION 2

- (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Most candidates did extremely bad in this question. Very few candidates could obtain a mark of 80%.
- (b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
- 2.1 Candidates did not copy the given schematic of the mechanism accurately. Candidates did not understand the movement of the sliding rod DB. The candidates did not understand that end B had to slide in groove GH. Candidates struggled to do the simple math of subtracting the 25 mm from the total length of 165 to determine the length of AB.
- 2.2 Although this question was attempted with more success, there were still many errors with determining the uniform acceleration and retardation movement. Candidates did not divide the horizontal and vertical distances into equal (6 parts) to determine the movement. In many cases the candidates combined the method for uniform acceleration and retardation with simple harmonic motion, which lead to marks being lost for dividing the vertical distance. Candidates did not label the graph.
- (c) Provide suggestions for improvement in relation to Teaching and Learning
- Teachers must teach according to the CAPS document. Work that was done in Grade 10 & 11 must be revised in Grade 12.
 - Dividing circles into equal parts must be practiced more extensively.
 - Teachers need to explain the terminology that is used in practice to describe the movement of a mechanism, e.g., sliding, reciprocate, pivot, pin-jointed, crank, swivel guide, etc.
 - Learners must practice how to divide lines into equal parts.
 - Teachers must explain to learners that when they must determine the movement of UAR they need to divide the rotational (horizontal) and displacement (vertical) lines into at least 6 equal parts.
 - Learners must have proper drawing instrument to draw accurately.
- (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
- Learners must read the questions carefully to avoid doing the wrong movements.
 - Freehand drawing of smooth curves through specific points need improvement.

QUESTION 3

- (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? Some centres did well in this question, but there are still centres where the candidates performed very poorly.
- (b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
- Many candidates still have a problem mastering the following:
 - Constructing auxiliary views (hexagon).
 - Drawing the isometric circle was very poorly done and even in well answered questions the learners left out the centre lines.
 - The candidates still struggle to draw the hexagon in isometric.
 - Candidates do not try to draw neatly and then forfeit marks, because there is no distinction between construction lines and outlines.
 - Drawing accurately is a big concern.
 - Many learners still cannot convert a 2D drawing into a 3D drawing.
- (c) Provide suggestions for improvement in relation to Teaching and Learning
- Learners need to practice how to convert from 2D to 3D. Make use of models that you can make out of modelling clay, polystyrene, wood, cardboard or even use a 3d printer if you have access to one. When a learner can “see” what he needs to draw then it will make it easier for him to practice the “reading” of the object.
 - More attention should be given to the following aspects:
 - Visibility of the lines (line quality is poor)
 - Candidates are battling to master the method of constructing a circle. Compass work is poor.
 - Centre lines must be practiced and drawn.
- (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
- Most learners fail to apply the correct line type, visible outlines compared to construction lines.
 - Educators should guide candidates on how to draw precise 90- and 30-degree lines of isometric drawings, using correct scale and given dimensions.
 - Proper instruments should be used and checked regularly.
 - Emphasis to all grades.

QUESTION 4

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Most learners attempted the question. The question was not answered well.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

- Planning of the placement of views is critical (3rd angle).
- Learners did not measure properly and drew inaccurately.
- Improper or incorrect placement of parts of the assembly.
- Some learners did not use proper instruments.
- Centre lines were very poorly drawn or omitted.
- Very few learners were able to construct the nut properly.
- Candidates used civil hatching, hatched at the wrong angle, and did not differentiate between parts (spacing & direction).
- Parts of the assembly were drawn as unassembled.
- Proper instruments should be used and checked regularly.

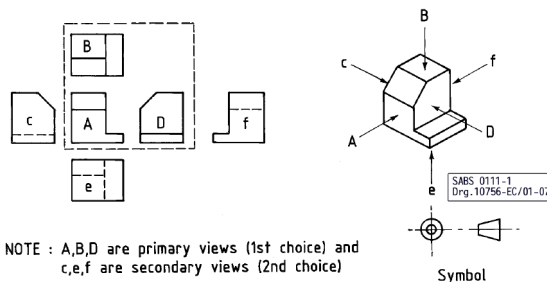
(c) Provide suggestions for improvement in relation to Teaching and Learning

- Pay attention to drawing in Third Angle Orthographic projection.

6.2.2 Third angle projection

In third angle projection, with reference to the front view, A, the other views should be arranged as follows (see figure 12):

- top view, B, is placed above;
- left view, c, is placed on the left;
- right view, D, is placed on the right;
- bottom view, e, is placed below; and
- rear view, f, is placed on either the left or the right, as convenient.



NOTE : A,B,D are primary views (1st choice) and c,e,f are secondary views (2nd choice)

- Although line quality is not evaluated, neat drawings are easier to read and clarify the drawing. Learners must practice drawing neatly, because only correctly used line work is marked, e.g., outlines must stand out above construction lines and hidden detail lines. Centre lines and hidden detail lines

Table 3 — Types of lines

1	2	3
Line	Description	General applications
A	Continuous thick	A1 Visible outlines A2 Visible edges
B	Continuous thin (straight or curved)	B1 Imaginary lines of intersection B2 Dimension lines B3 Projection lines B4 Leader lines B5 Hatching B6 Outlines of revolved sections in place B7 Short centre lines B8 Bending lines
C	Continuous thin freehand	C1 Limits of partial or interrupted views and sections, if the limit is not a chain thin
D*	Continuous thin (straight) with zigzags	D1 Break line
E	Dashed thick*	E1 Hidden outlines E2 Hidden edges
F	Dashed thin	F1 Hidden outlines F2 Hidden edges
G	Chain thin	G1 Centre lines G2 Lines of symmetry G3 Trajectories

must be correctly drawn and applied.

- Pay attention to basic knowledge such as the manual construction of nuts and bolts.
- The part section on the key was left out.

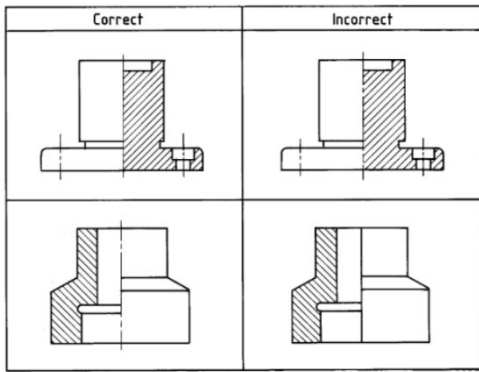


Figure 22 — Half section showing the correct and incorrect presentation

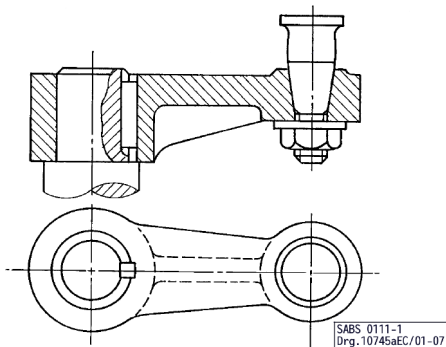
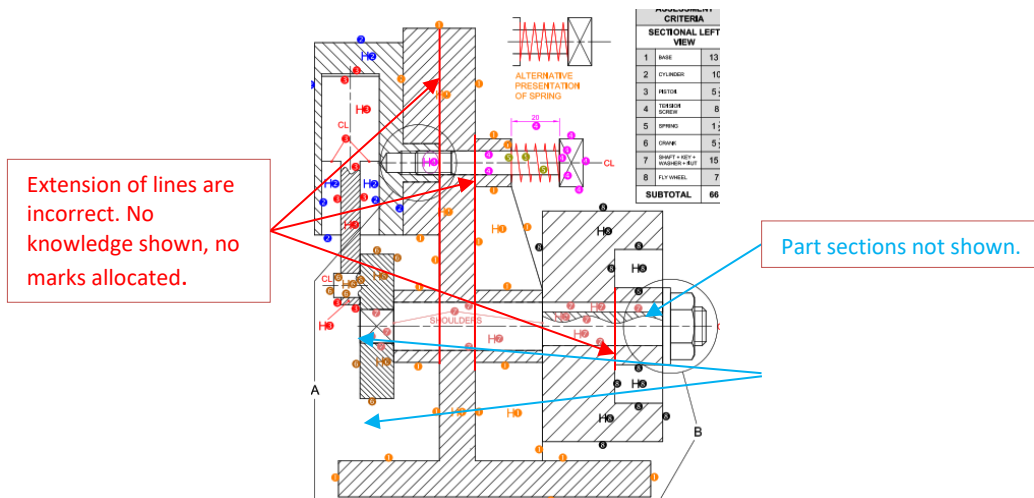


Figure 28 — Rib, shaft, key, crank pin, nut and washer, not sectioned

- Same as with question 1 teachers must make use of old mechanical parts that they can get from their local automotive repair shops, and use them as examples for their learners to understand the different components and their workings. Disassemble the parts and put them back together so that the learners can see how parts fit together.
- Learners do not know the rules of sectioning.



- PARTS MUST BE ASSEMBLED.

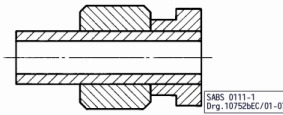
7.2.1 Standard hatching

- a) Hatching should be used (preferably at an angle of 45° to the axis or main outline) to make the area sectioned evident (see figure 16). Hatching may be omitted where the meaning of the drawing is clear without it, but the practice followed should be consistent on any one drawing.



Figure 16 — Hatching of sections

- b) The spacing between the hatching lines may vary according to the size of the section but should be the same in all sectional views of the same component drawn to the same scale. Hatching on adjacent components should be drawn in different directions or to a different spacing (see figure 17).



7.3.2 Part section

A view may be drawn in part section to show detail that would otherwise be hidden (see figure 23).

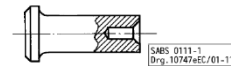


Figure 23 — Part section

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Planning of time per question is critical. 1.1 marks should be completed per minute. Roughly 85 minutes should be spent on 93 marks.
- Planning of drawing layout needs attention.
- Line quality must improve.
- Learners do not practice the assembly drawings enough.
- While preparing learners, to answer assemblies, special attention must be given to hatching of different components and hatching rules.
- Also revise construction of nuts, washers and bolts again.
- Line types and their use must be stressed.
- Take note of use of centre lines and cutting planes.



basic education

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Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2022

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	↓	SIGN	MODERATED	↓	SIGN
1						
2						
3						
4						
TOTAL	200			200		200

FINAL CONVERTED MARK

100

CHECKED BY

COMPLETE THE FOLLOWING:

CENTRE NUMBER

CENTRE NUMBER

EXAMINATION NUMBER

EXAMINATION NUMBER



QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

- A schematic drawing of a mechanism consisting of crank OA, sliding rod DB, horizontal groove GH, swivel guide F and rod CE in the vertical position
- The position of centre point O on the drawing sheet

Specifications:

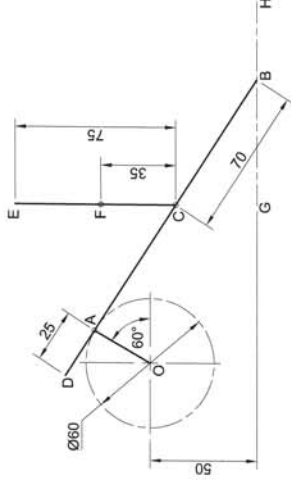
- The positions of centre point O, swivel guide F and horizontal groove GH are fixed.
- Rod DB = 165.
- Sliding rod DB is pin-jointed to crank OA at A.
- Rod CE passes through swivel guide F, and is pin-jointed to sliding rod DB at C.

Motion:

As crank OA rotates, point B of sliding rod DB reciprocates along groove GH and rod CE slides through swivel guide F.

Instructions:

- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
- Trace the loci generated by point D and by point E for ONE complete rotation of crank OA.
- Show ALL construction. [25]



ASSESSMENT CRITERIA 2.1		
1	GIVEN + LABELS + CL	6
2	CONSTRUCTION	5
3	LOCI OF D + E	14
PENALTIES (-)		
SUBTOTAL		25

2.2: CAM

Given:

- The position of corner P on the drawing sheet

Motion:

A cam imparts the following motion to a follower.

- It is at rest for the first 60°.
- It rises 80 mm with uniform acceleration and retardation over the next 150°.
- It returns to its original position with uniform motion over the rest of the rotation.

Instructions:

- From corner P, draw, to a rotational scale of 10 mm = 30° and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Label the displacement graph and include the rotational scale. [12]
- Show ALL construction.

ASSESSMENT CRITERIA 2.2		
1	GRAPH CONSTRUCTION	5
2	POINTS + CURVE	6
3	LABELS	1
PENALTIES (-)		
SUBTOTAL 2.2		12
SUBTOTAL 2.1		25
TOTAL		37



EXAMINATION NUMBER	
EXAMINATION NUMBER	3



QUESTION 4: MECHANICAL ASSEMBLY

Given:

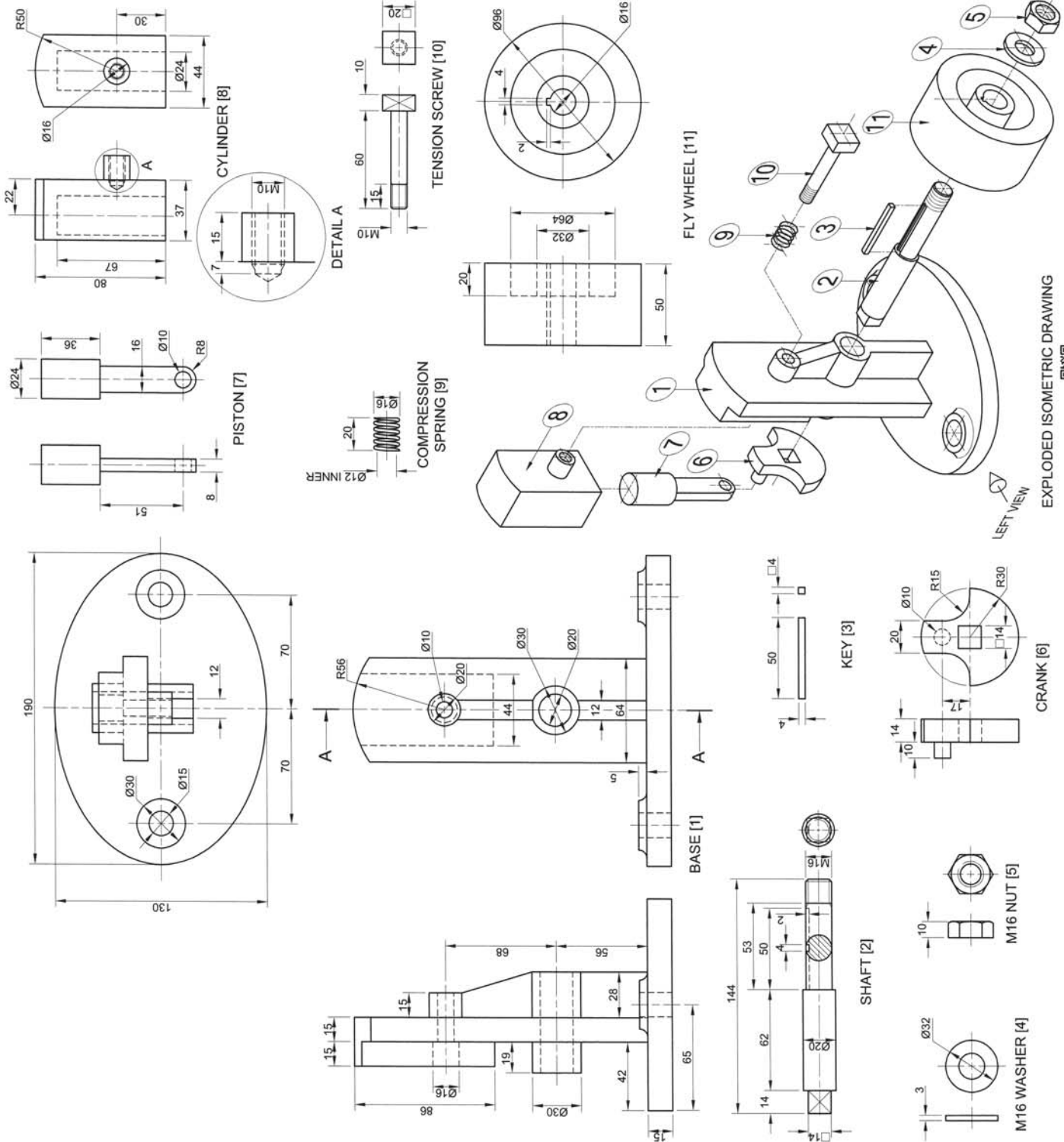
- The exploded isometric drawing of the parts of a wobble engine assembly, showing the position of each part relative to all the others
- Orthographic views of each of the parts of the wobble engine assembly

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 wobble engine assembly:
 - ONLY the left half of the front view, by applying the convention of symmetry
 - A sectional left 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 front view of the base (part 1).

NOTE:

- Planning is essential.
- The drawing must comply with the SANS 10111 guidelines.
- The crank (part 6) must be drawn as shown, so that the piston (part 7) will be in the highest position.
- Show THREE faces of the M16 nut (part 5) on the sectional left view.
- The compression spring (part 9) must be drawn as a conventional representation, at the given length of 20 mm. [93]
- NO hidden detail is required.



PARTS LIST		
PARTS	QUANTITY	MATERIAL
1 BASE	1	CAST IRON
2 SHAFT	1	MILD STEEL
3 KEY	1	KEY STEEL
4 M16 WASHER	1	MILD STEEL
5 M16 NUT	1	MILD STEEL
6 CRANK	1	CAST IRON
7 PISTON	1	MILD STEEL
8 CYLINDER	1	CAST IRON
9 COMPRESSION SPRING	1	SPRING STEEL
10 TENSION SCREW	1	MILD STEEL
11 FLY WHEEL	1	CAST IRON

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WOBBLE ENGINE ASSEMBLY

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			
FRONT VIEW			
	POSSIBLE	OBTAINED	MARKED
1	BASE	5 1/2	
2	TENSION SCREW	1 1/2	
3	FLY WHEEL	1	
4	NUT + WASHER	4 1/2	
5	INDICATION OF SYMMETRY	2	
SUBTOTAL		14 1/2	

SECTIONAL LEFT VIEW			
	POSSIBLE	OBTAINED	MARKED
1	BASE	13 1/2	
2	CYLINDER	10	
3	PISTON	5 1/2	
4	TENSION SCREW	8	
5	SPRING	1 1/2	
6	CRANK	5 1/2	
7	SHAFT + KEY + WASHER + NUT	15 1/2	
8	FLY WHEEL	7	
SUBTOTAL		66 1/2	

GENERAL			
	POSSIBLE	OBTAINED	MARKED
1	CENTRE LINES	2	
2	ASSEMBLY	10	
SUBTOTAL		12	
TOTAL		93	
PENALTIES (-)			
GRAND TOTAL			

EXAMINATION NUMBER	
EXAMINATION NUMBER	6





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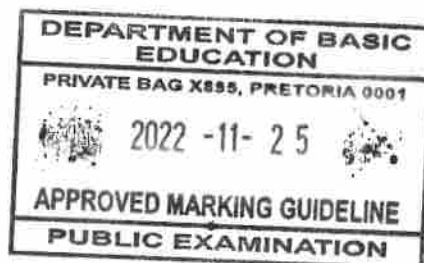
GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2022

MARKING GUIDELINES

MARKS: 100

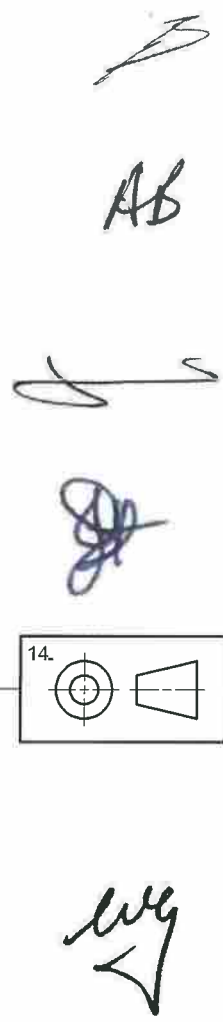


These marking guidelines consist of 7 pages.

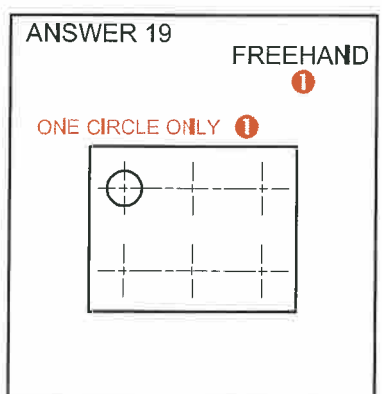
25 Nov 2022

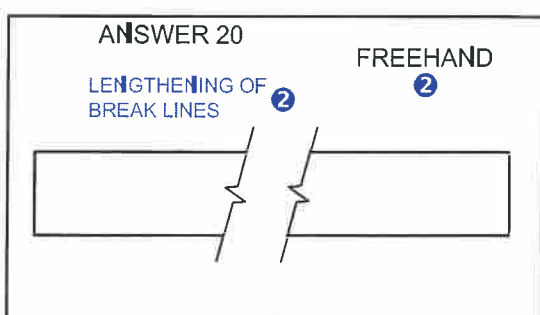
ANSWERS		
1	S.SMITH	1
2	3	1
3	MILD STEEL	1
4	6	1
5	SUCCESSIVE / REMOVED	1
6	3	1
7	BOTTOM VIEW	1
8	ACROSS FLATS	1
9	CSK	1
10	A: 126 B: Ø28 C: 10	3
11	2	1
12	3	1
13	40	1
14	LEFT	1
15	M34 x 3	1
16	8	1
17	16.98	2
18	MACHINING ALLOWANCE / TOLERANCE	1
	ROUGHNESS VALUE	1
	METHOD / TREATMENT / COATING / PROCESS	1
	DIRECTION OF LAY / CIRCULAR / PATTERN	1
19	See below	3
20		3
TOTAL		30



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 APPROVED MARKING GUIDELINE
 PUBLIC EXAMINATION



HORIZONTAL CLs without CIRCLES 2 x 0.5
 VERTICAL CLs without CIRCLES 2 x 0.5



PARALLEL BREAK LINES 2 x 0.5
 ZIG ZAG 2 x 0.5

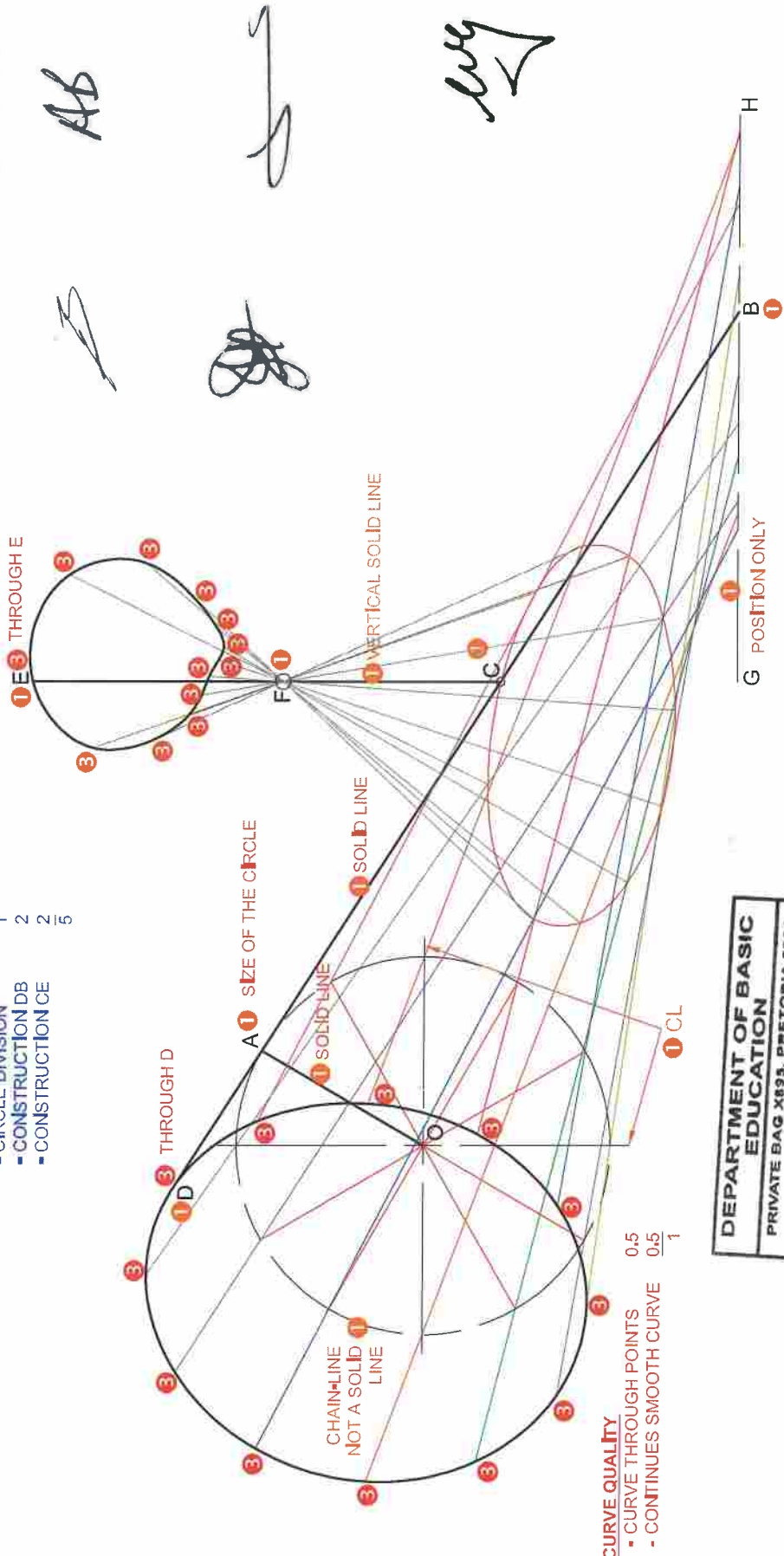
NOTE: BREAKLINES CAN BE ALIGNED or VERTICAL

PAPER 2 QUESTION 1
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

ASSESSMENT CRITERIA 2.1	
1	GIVEN + LABELS + CL
2	CONSTRUCTION
3	LOC OF D + E
SUBTOTAL 2.1	
25	

CURVE QUALITY
 - CURVE THROUGH POINTS 0.5
 - CONTINUES SMOOTH CURVE 0.5
 1

2.1 CONSTRUCTION
 - CIRCLE DIVISION 1
 - CONSTRUCTION DB 2
 - CONSTRUCTION CE 2
 5

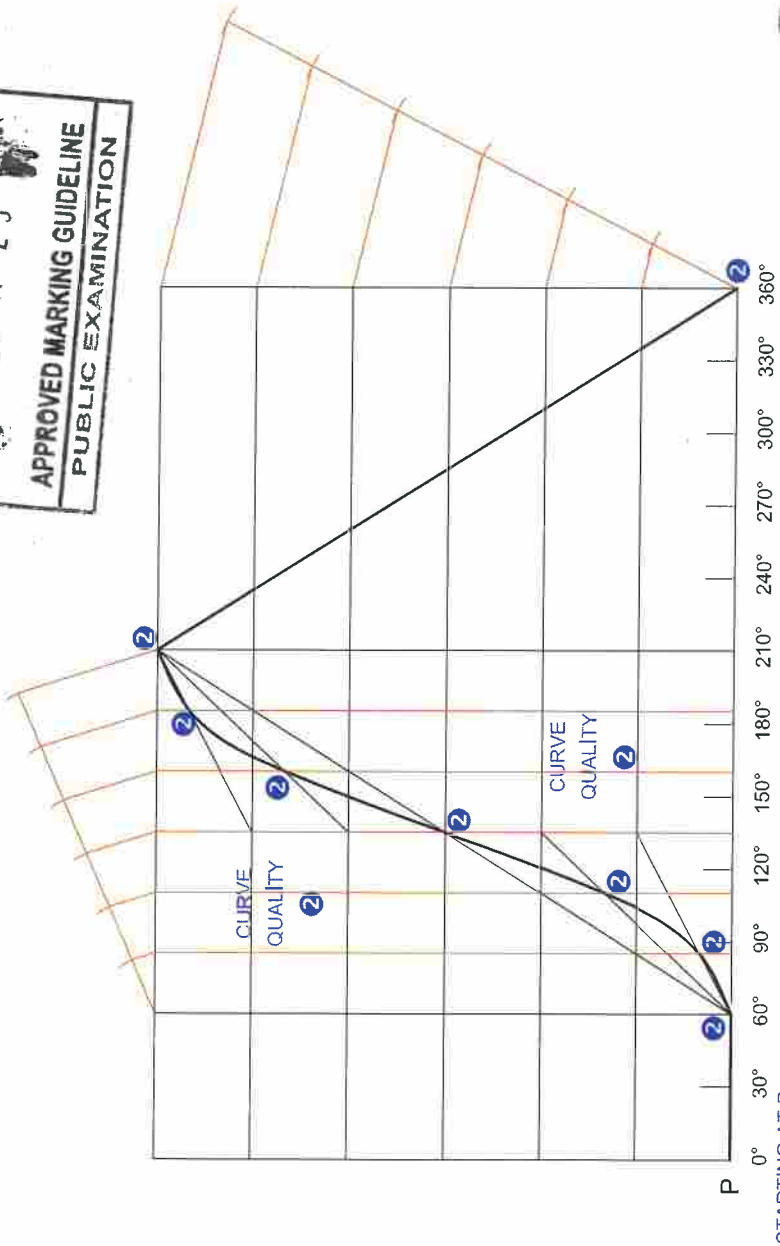


CURVE QUALITY
 - CURVE THROUGH POINTS 0.5
 - CONTINUES SMOOTH CURVE 0.5
 1

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PAPER 2 QUESTION 2
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

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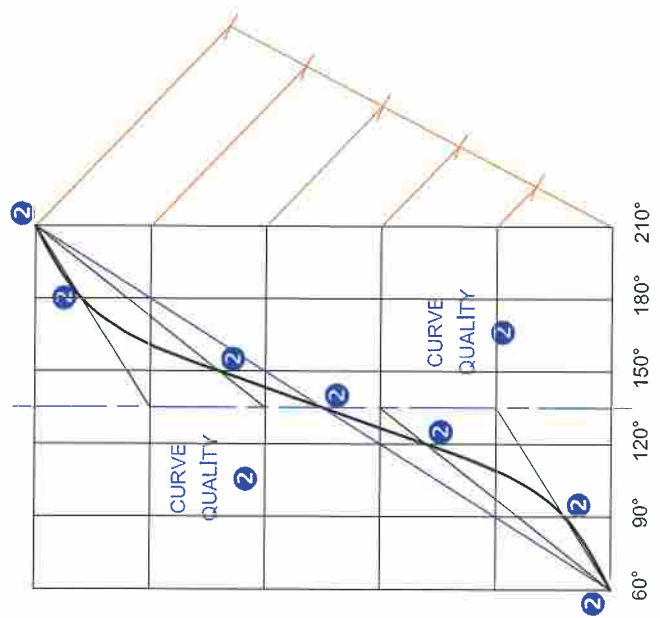


DISPLACEMENT GRAPH 3
 SCALE 10 mm = 30° 3

1. CONSTRUCTION
- LENGTH 120 + LINE DIVISIONS (1 + 1/2)
 - 150° HORIZONTAL LINE DIVISION for UAR
 - VERTICAL DIVISIONS for UAR (hor / vert. division number must be equal)
 - FIRST HALF CONSTRUCTION for UAR
 - SECOND HALF CONSTRUCTION for UAR

NOTE ON CURVE QUALITY
 MUST BE THROUGH DETERMINED POINTS, & CURVE MUST BE CONTINUOUS AND SMOOTH

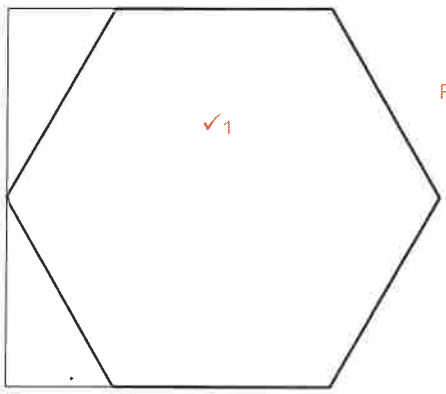
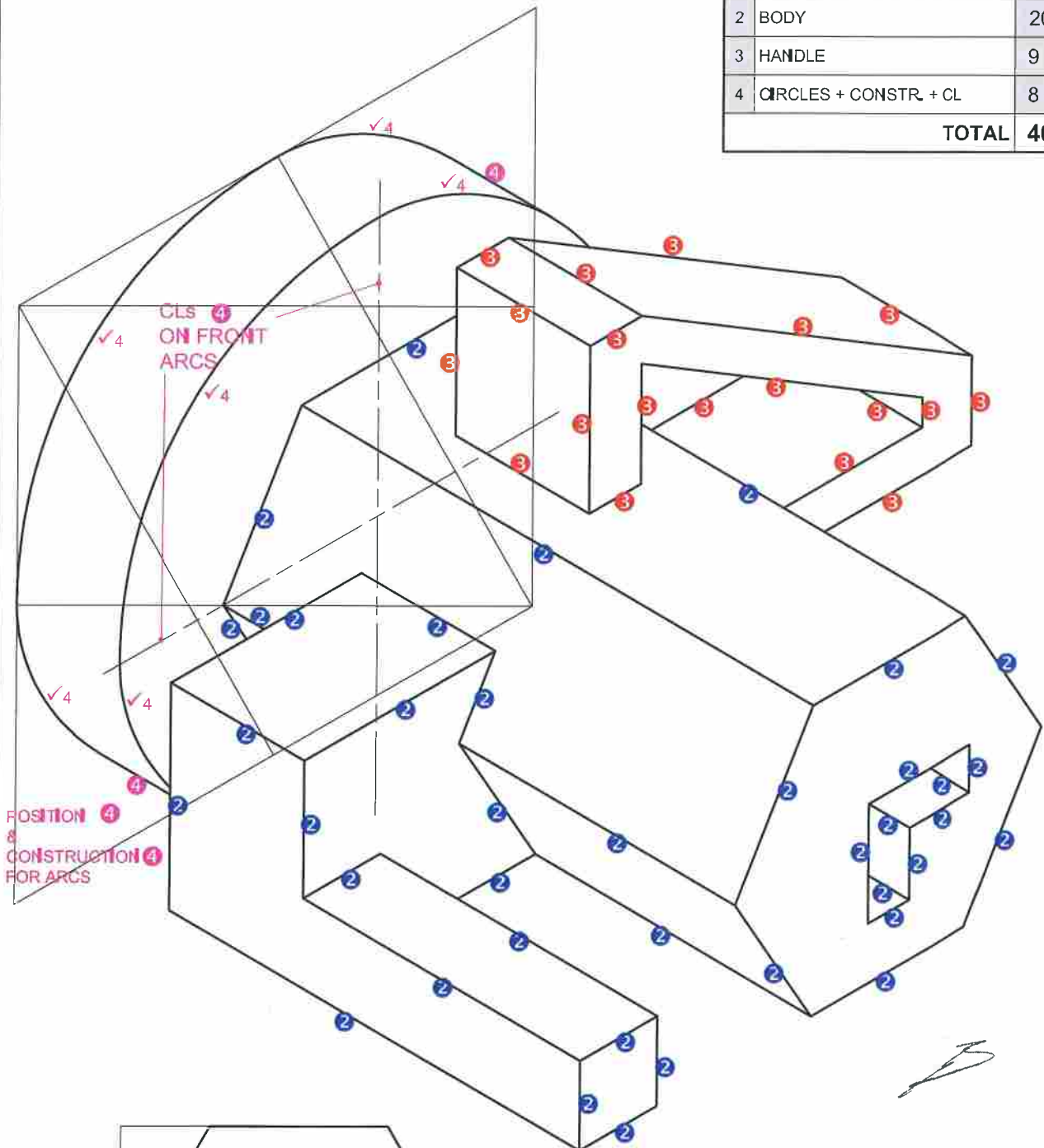
ALTERNATIVE FOR 5 EQUAL DIVISIONS



ASSESSMENT CRITERIA 2.2	
1	GRAPH CONSTRUCTION 5
2	POINTS + CURVE 6
3	LABELS 1
SUBTOTAL 2.2 12	

PAPER 2 QUESTION 2
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

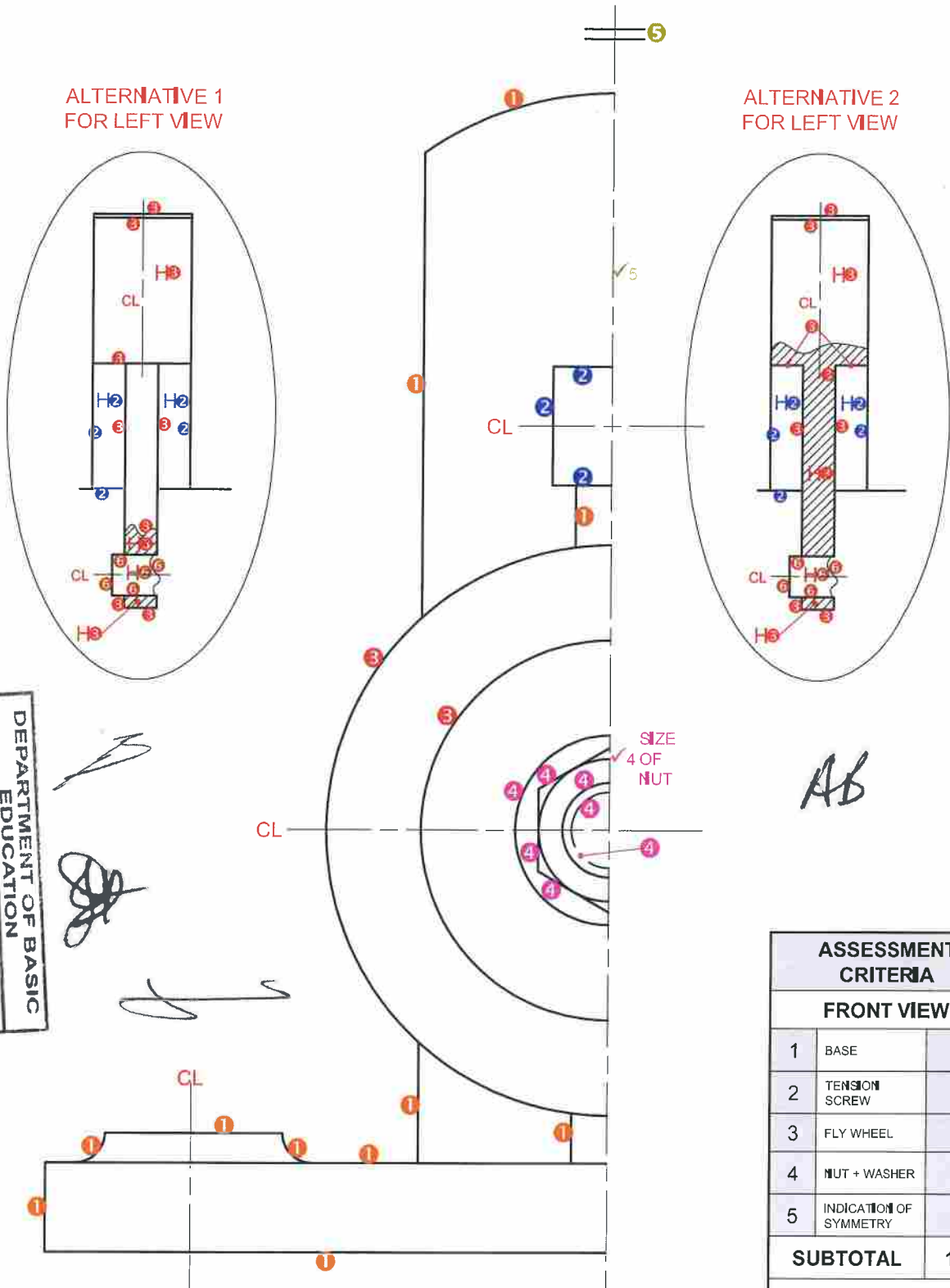
ASSESSMENT CRITERIA		
1	PLACING + AUX. VIEW	2
2	BODY	20
3	HANDLE	9 1/2
4	CIRCLES + CONSTR. + CL	8 1/2
TOTAL		40



A
PLACEMENT / ORIENTATION ✓1

[Handwritten signatures and initials]
AB

PAPER 2 QUESTION 3
GRADE 12
NOVEMBER 2022
MARKING GUIDELINE



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 APPROVED MARKING GUIDELINE

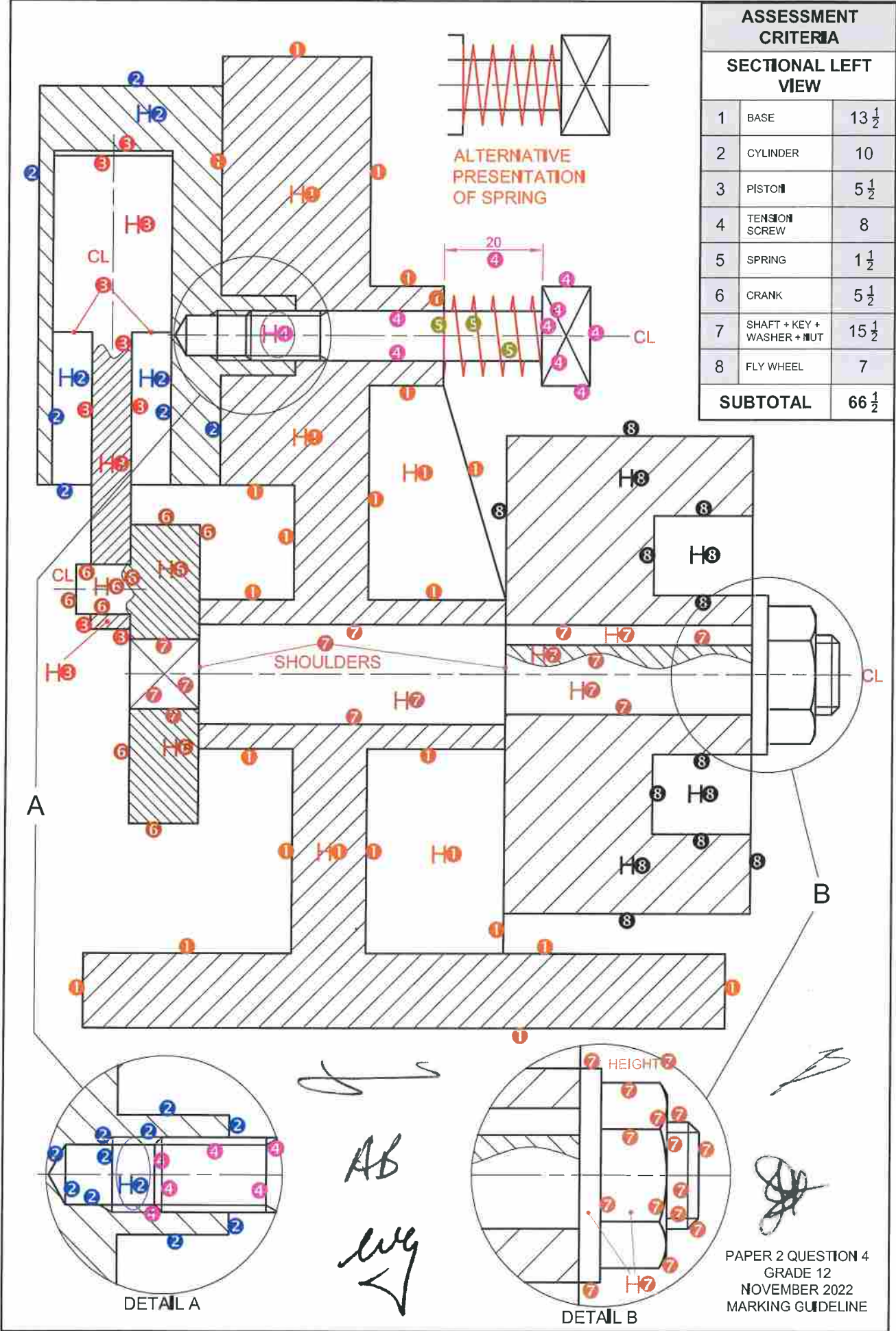
1. CENTRE LINES
 SANS COMPLIANT
 1-4 = 0,5; 5-7 = 1
 1
 1/2

2. ASSEMBLY
 1 MARK FOR EVERY COMPONENT
 CORRECTLY ASSEMBLED (11 PARTS - 1) = 10

ASSESSMENT CRITERIA		
FRONT VIEW		
1	BASE	5 1/2
2	TENSION SCREW	1 1/2
3	FLY WHEEL	1
4	NUT + WASHER	4 1/2
5	INDICATION OF SYMMETRY	2
SUBTOTAL		14 1/2
GENERAL		
1	CENTRE LINES	2
2	ASSEMBLY	10
SUBTOTAL		12

PAPER 2 QUESTION 4
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

ASSESSMENT CRITERIA		
SECTIONAL LEFT VIEW		
1	BASE	13 1/2
2	CYLINDER	10
3	PISTON	5 1/2
4	TENSION SCREW	8
5	SPRING	1 1/2
6	CRANK	5 1/2
7	SHAFT + KEY + WASHER + NUT	15 1/2
8	FLY WHEEL	7
SUBTOTAL		66 1/2

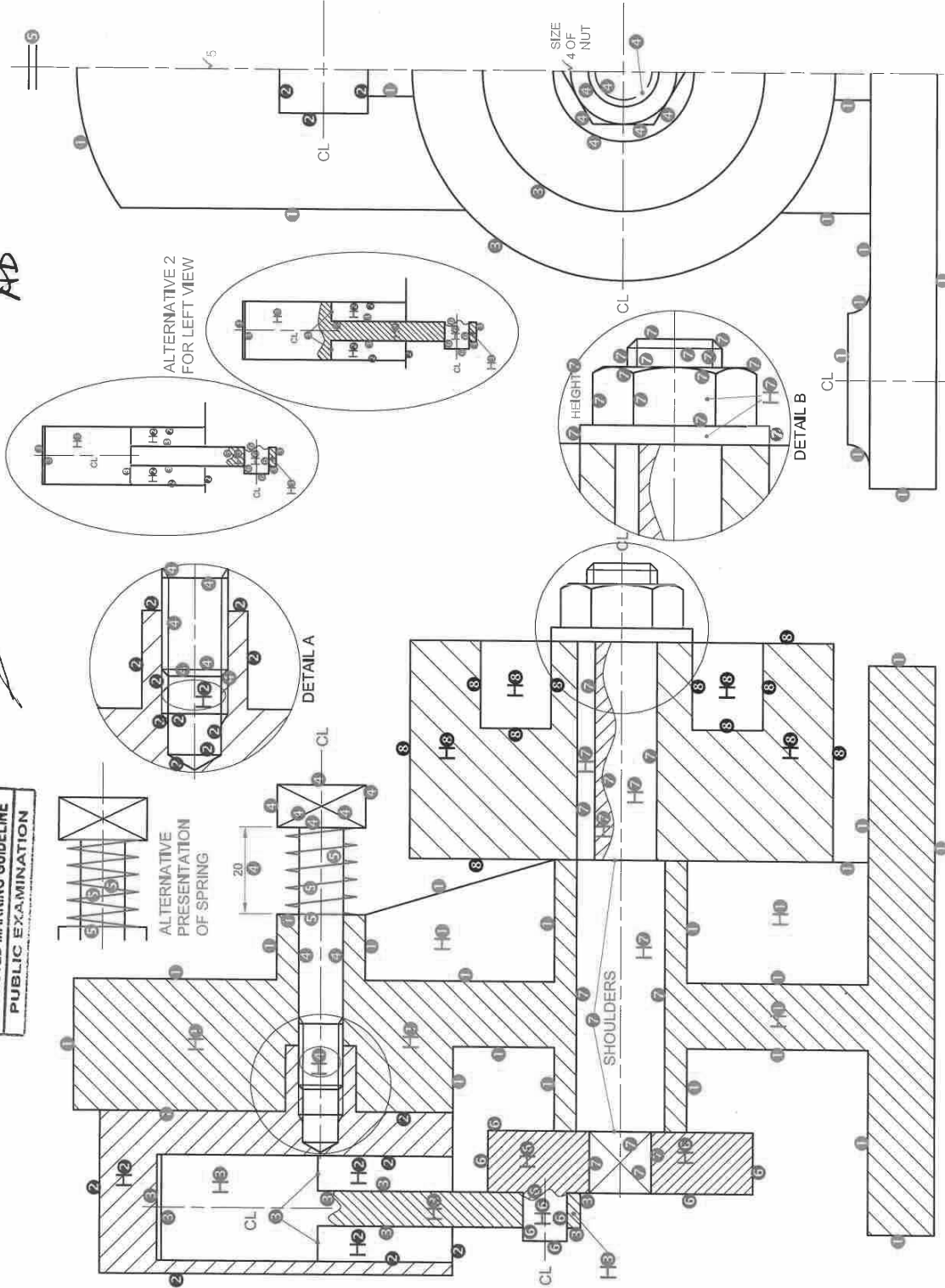


PAPER 2 QUESTION 4
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

DEPARTMENT OF BASIC EDUCATION
 PRIVATE BAG 4695, PRETORIA 0081
 2022 -11- 2 5
 APPROVED MARKING GUIDELINE
 PUBLIC EXAMINATION

AB

ALTERNATIVE 1
FOR LEFT VIEW



my

1. CENTRE LINES
 SANS COMPLIANT
 1 - 3 = 0,5; 4 - 7 = 1

2. ASSEMBLY
 1 MARK FOR EVERY COMPONENT
 CORRECTLY ASSEMBLED (11 PARTS - 1) = 10

[Signature]

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

ASSESSMENT CRITERIA			
FRONT VIEW			
	POSSIBLE	OBTAINED	SCORE MODERATED
1	BASE	5 ½	
2	TENSION SCREW	1 ½	
3	FLY WHEEL	1	
4	NUT + WASHER	4 ½	
5	SYMMETRY	2	
SUBTOTAL		14 ½	

SECTIONAL LEFT VIEW			
1	BASE	13	
2	CYLINDER	10 ½	
3	PISTON	5 ½	
4	TENSION SCREW	8	
5	SPRING	1 ½	
6	CRANK	5 ½	
7	SHAFT + KEY + WASHER + NUT	17 ½	
8	FLY WHEEL	7	
SUBTOTAL		68 ½	

GENERAL			
1	CENTRE LINES	2	
2	ASSEMBLY	10	
SUBTOTAL		12	
TOTAL		95	
PENALTIES (-)			
GRAND TOTAL			