



Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2023

ENGINEERING – MATERIALS AND TECHNOLOGY

(Ordinary level – 200 marks)

THURSDAY, 8 JUNE

MORNING 9:30 – 12:00

Answer any **FOUR** questions.

All questions carry equal marks.

The 2023 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

Question 1.

(50 marks)

Give **brief** answers to **any eight** of the following:

(a) State **one** application of remote-control technology.

(b) Explain the term *brittleness*.

(c) State **two** reasons why pilot holes are used when drilling.

(d) List **one** advantage of using thumbscrews when assembling parts.

(e) Give **one** application of a strip heater when working with plastics.

(f) Identify tool **A** shown **and** give **one** application for it.

(g) Give **one** reason why it is important to wear ear protection when working in a workshop.

(h) Explain **any one** of the following:

(i) CAD Modelling,

(ii) Artificial intelligence (AI),

(iii) Electric vehicle.

(i) Explain the term *upcycling*.

(j) Describe the main operating features of **any one** of the following:



(i) Scissor jack,



(ii) Foot shears,



(iii) Soldering iron.

(k) Define *electrical conductor* in relation to the properties of metals **and** name **one** metal which is used as an electrical conductor.

(l) Explain **any one** of the following:

(i) Pop riveting,

(ii) Countersinking,

(iii) Blind hole.

(m) List **two** benefits of using cutting fluids when machining.



**remote-control
technology**



thumbscrew



tool A

- (a) Explain **any three** of the following furnace-related terms:
- (i) Water-cooled oxygen lance, (ii) Pig iron, (iii) Carbon electrodes, (iv) Iron ore.
- (b) With the aid of a labelled diagram, describe the operation of **any one** of the following furnaces:
- (i) Blast furnace, (ii) Basic oxygen furnace, (iii) Electric arc furnace.
- (c) Electric go-karts have become popular in recent years. You have been asked to manufacture an electric go-kart suitable for a teenager.
- (i) Name a suitable material for **each** of the parts labelled on the electric go-kart below.
- (ii) State **one** reason for the selection of **each** material.



- (d) Car wheel rims are often manufactured from a metal alloy.
- (i) Explain the term **alloy**.
- (ii) Name **one** metal alloy **and** name the metals used in its production.



Question 3.

(50 marks)

(a) Explain **any two** of the following heat treatment procedures:

(i) Annealing,

(ii) Case hardening,

(iii) Quenching.

(b) Kitchen knives are hardened and tempered during manufacture.

(i) What effect does hardening have on steel?

(ii) Describe the tempering process.



(c) Identify **two** safety precautions to be observed when working with hot metals.



(d) Explain **any two** of the following metal properties:

(i) Toughness,

(ii) Ductility,

(iii) Malleability.

OR

(d) (i) Describe **two** areas where robotic technology is used in health care.

(ii) State **two** ways in which exoskeleton suits can help the recovery process.



Question 4.

(50 marks)

- (a) (i) Name **two** common gases used in gas welding.
- (ii) Name **two** types of flame produced when gas welding.
- (iii) State **two** safety precautions that should be followed when gas welding.



- (b) State the function of **any three** of the following in manual metal arc welding:



- (i) Welding plant, (ii) Chipping hammer, (iii) Leather apron, (iv) Electrode holder.

- (c) Answer **any three** of the following:

- (i) Explain why a passive flux is used when soldering electrical circuits.

- (ii) Name **one** process that can be used to permanently join sheet metals.

- (iii) Give **one** reason why it is important to clean grease and corrosion from joints before soldering.

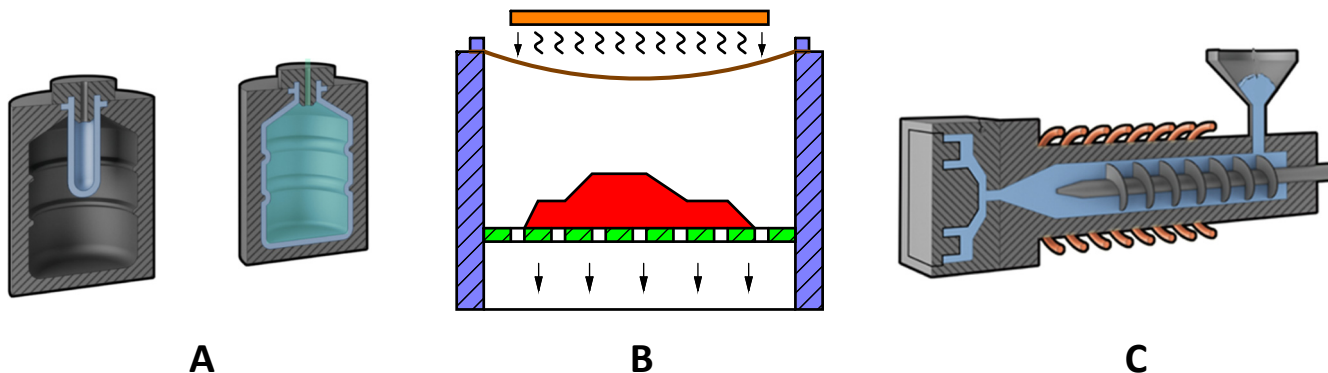
- (iv) Name the cutting tool shown **and** state a suitable use for it.



cutting tool

- (d) State **two** safety precautions to be observed when working with adhesives.

- (a) (i) Name the **three** plastic manufacturing processes shown at **A**, **B** and **C**.



- (ii) Describe with the aid of a labelled diagram **any one** of the manufacturing processes named by you at 5(a)(i) above.

- (b) In relation to plastic technology, describe **any three** of the following:

- (i) Elastic memory;
- (ii) Thermosetting plastics;
- (iii) Plastic dip coating;
- (iv) Thermoplastic.

- (c) Select **any two** of the products shown below and name a plastic material which is suitable for the manufacture of **each** product:



(i) Toy car,



(ii) Bevel gears,



(iii) Electrical socket,



(iv) Food container.

- (d) State **two** safety precautions to be observed when working with hot plastics.

- (a) Name **any three** of the lathe parts shown at **A**, **B**, **C** and **D**.

**A****B****C****D**

- (b) Explain **any three** of the following in relation to machining:

(i) Clearance angle, (ii) Spindle speed, (iii) Rake angle, (iv) Feed.

- (c) The thumbscrew shown opposite was manufactured on a lathe.

(i) Name **two** lathe processes used in the manufacture of the thumbscrew.

(ii) Describe **one** of the processes named by you, at 6(c)(i) above.

(iii) Name **two** items of personal protective equipment (PPE) that should be worn when operating a lathe.

**thumbscrew**

OR

- (c) 3D printing is now a popular CNC process.

(i) What does CNC stand for?

(ii) Identify **one** other CNC process.

(iii) List **two** advantages of using CNC machines in manufacturing.

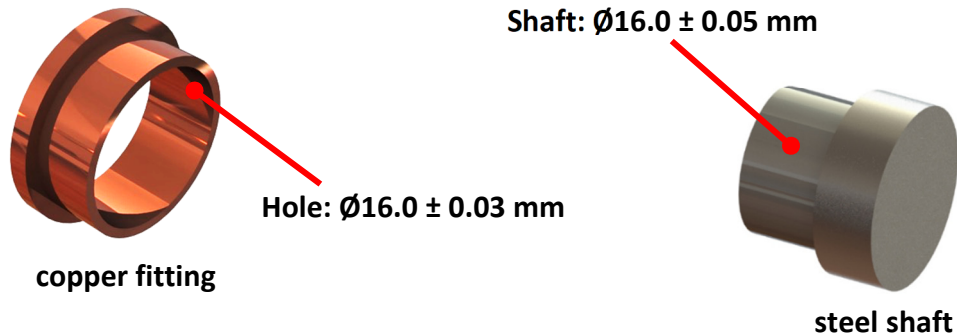


Question 7.

(50 marks)

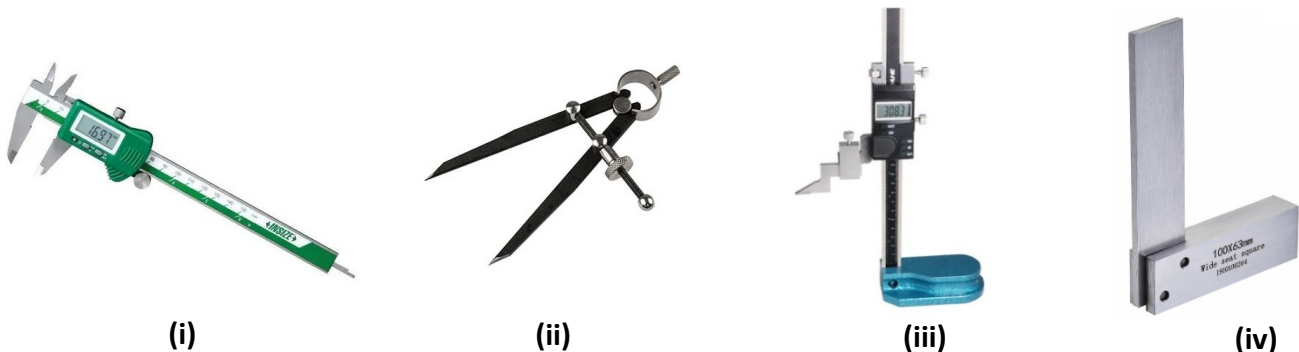
- (a) Explain **any two** of the following terms in relation to limits and fits:
- (i) Clearance fit, (ii) Upper limit, (iii) Transition fit.

- (b) A copper fitting and a steel shaft are machined to the dimensions shown below.



- State the:
- (i) Largest diameter of the **hole** in the copper fitting.
 - (ii) Nominal diameter of the **shaft**.
 - (iii) Smallest diameter of the **shaft**.
 - (iv) Tolerance of the **hole** in the copper fitting.

- (c) Name **any three** of the instruments shown **and** give **one** application of **each** instrument named.



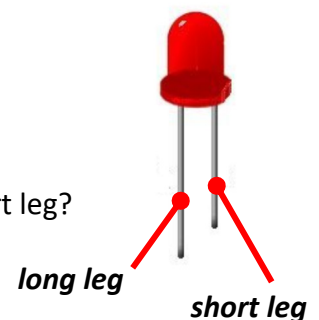
OR

- (c) Answer **all** of the following:

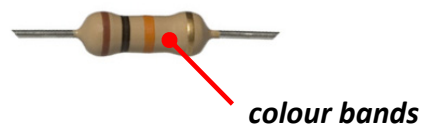
- (i) State **one** use of a solenoid.



- (ii) Why does the light emitting diode shown have one long leg and one short leg?



- (iii) State the function of the colour bands on the fixed resistor shown.





Leaving Certificate Examination, 2023

Engineering - Practical (150 marks)

Morning: 10:00 to 1:00 - Afternoon: 2:00 to 5:00

Please Read Carefully

Instructions

- (a) The Examination Number must be clearly stamped or engraved, by the **teacher**, on the test-piece in the position indicated on the examination paper - 2023. M74A(L₂).
If the test-piece is not assembled, the Examination Number must be indicated on each separate part of the test-piece.
- (b) Candidates are not permitted to communicate with or assist one another.
- (c) Write your Examination Number in the box provided on the examination paper - 2023. M74A(L₁).
- (d) Put the examination paper - 2023. M74A(L₁) and the test-piece into the candidate envelope supplied and hand up the envelope to the Superintendent at the end of the examination.

From the materials supplied, make the **Mechanism** shown on the drawings to the shape and dimensions specified.

PART	MATERIAL	PROCESS
3	Brass	Mark out, drill and shape.
6	U-Aluminium	Mark out, drill and shape.
8	Clear Polycarbonate	Mark out and shape.
9	Aluminium	Mark out, drill and shape.
10	Clear Polycarbonate	Mark out, drill and shape.

Note: (i) Parts 1, 2, 4, 5 and 7 have been made prior to examination day.
Using the threaded bar, screws and nuts supplied assemble the mechanism, as detailed on the assembly drawing.

(ii) **Accuracy, finish and function are important.**



Scrúdú na hArdteistiméireachta, 2023

Innealtóireacht - Praiticiúil
(150 marc)

Maidin: 10:00 go dtí 1:00 - Tráthnóna: 2:00 go dtí 5:00

Léigh na Treoracha seo go cúramach le do thoil

Treoracha

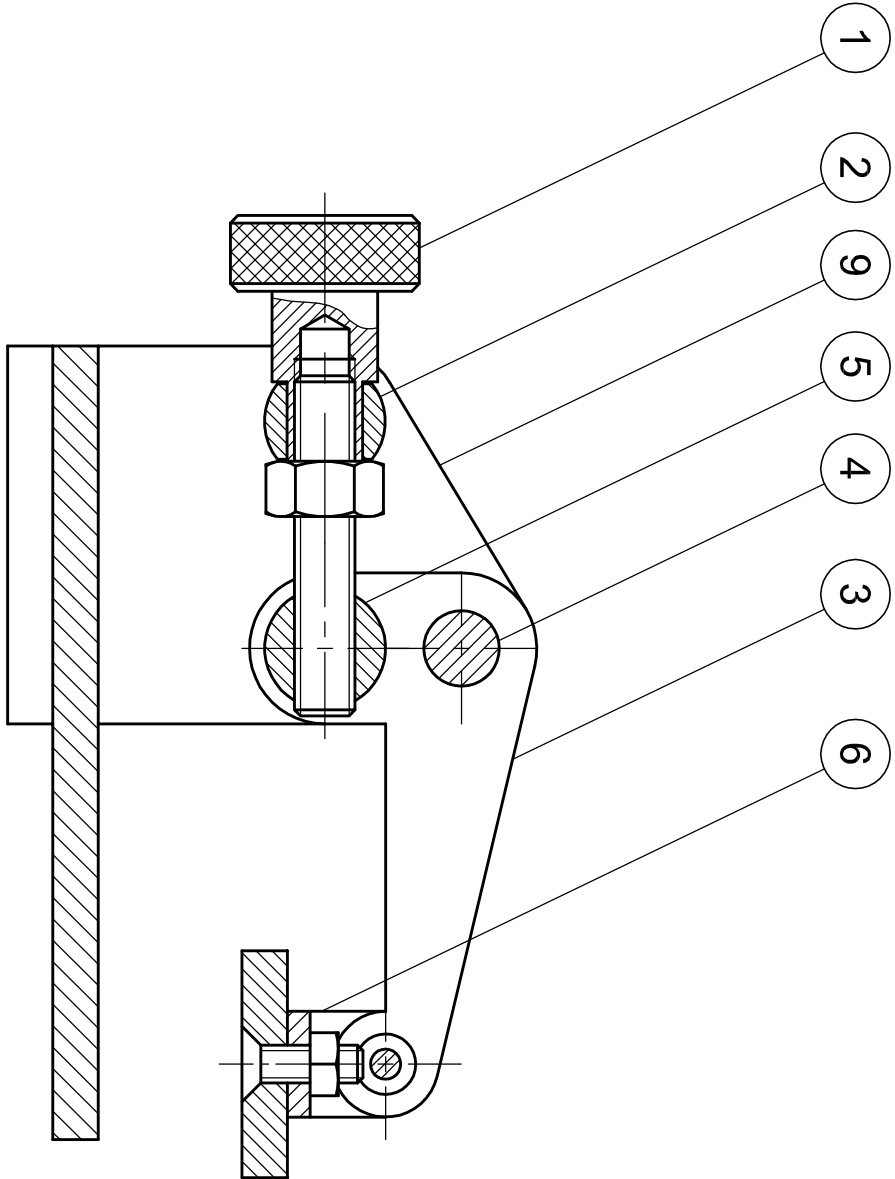
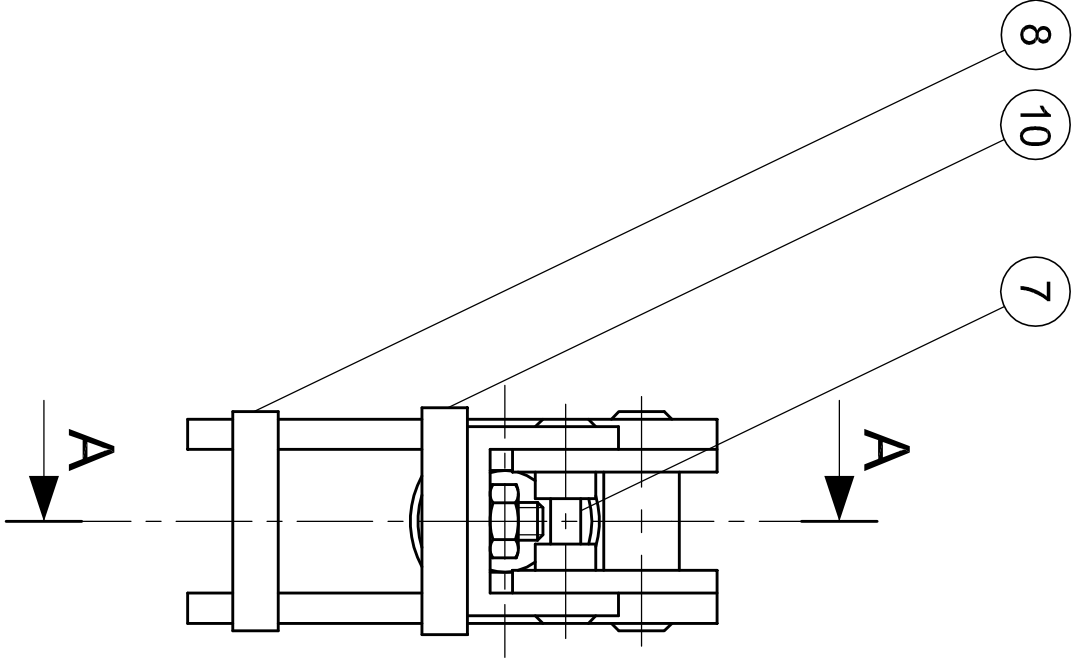
- (a) Ba chóir don **mhúinteoir** Scrúduimhir an iarrthóra a stampáil nó a ghreanadh ar an triailphíosa san ionad a thaispeántar ar an scrúdpháipéar - 2023. M74A(L₂). Mura bhfuil an triailphíosa curtha le chéile, ní mór an Scrúduimhir a thaispeáint ar gach páirt ar leith den triailphíosa.
- (b) Níl cead ag iarrthóirí a bheith i gcumarsáid le chéile ná cúnamh a thabhairt dá chéile.
- (c) Scríobh do Scrúduimhir sa bhosca atá ann di ar an scrúdpháipéar - 2023. M74A(L₁).
- (d) Cuir an scrúdpháipéar - 2023. M74A(L₁) agus an triailphíosa isteach i gclúdach an iarrthóra atá curtha ar fáil agus tabhair an clúdach don Fheitheoir ag deireadh an scrúdaithe.

As na hábhair a sholáthraítear, déan an **Mheicníocht** a thaispeántar sna líníochtaí sa chruth agus sna toisí a shonraítear.

PÁIRT	ÁBHAR	PRÓISEAS
3	Prás	A mharcáil amach, a dhruileáil agus a dheilbhiú.
6	U-Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
8	Polacarbónáit thrédhearcach	A mharcáil amach agus a dheilbhiú.
9	Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
10	Polacarbónáit thrédhearcach	A mharcáil amach, a dhruileáil agus a dheilbhiú.

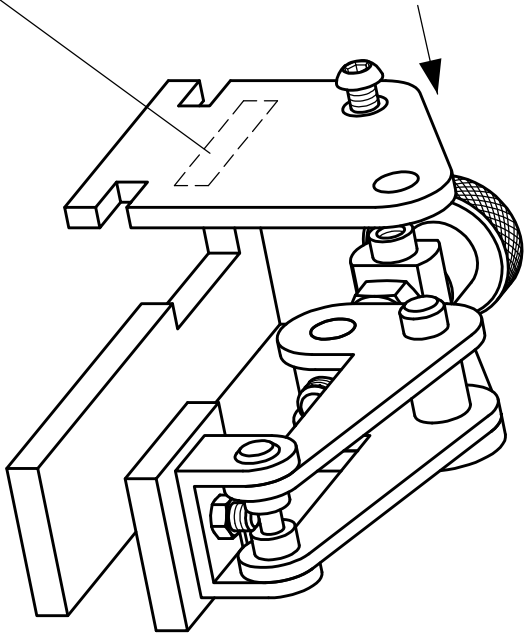
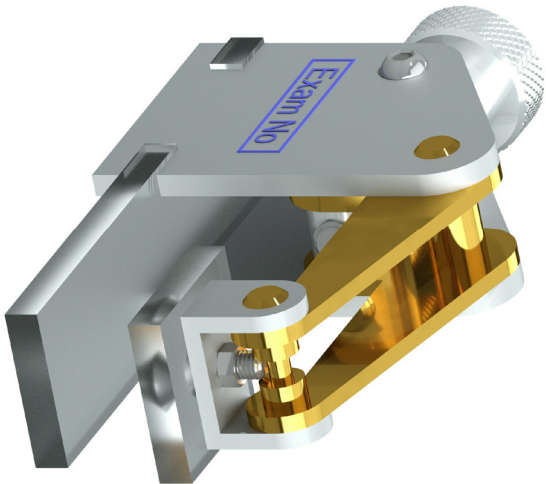
Nóta: (i) Rinneadh na páirteanna 1, 2, 4, 5 agus 7 roimh lá an scrúdaithe.
Agus tú ag baint úsáide as an barra snáithe, na scriúnná agus na cnónna a sholáthraítear, cóimeáil an mheicníocht faoi mar atá sa líníocht chóimeála.

(ii) Tá tábhacht ag baint le cruinneas, le bailchríoch agus le hoibriú an triailphíosa.



SECTION A-A

SCRÚDUIMHIR
EXAM NO.



ASSEMBLY DETAILS
SONRAÍ CÓIMEÁLA

THALL
OVER



Leaving Certificate Examination, 2023

Engineering - Practical (150 marks)

Morning: 10:00 to 1:00 - Afternoon: 2:00 to 5:00

Please Read Carefully

Instructions

- (a) The Examination Number must be clearly stamped or engraved, by the **teacher**, on the test-piece in the position indicated on the examination paper - 2023. M74A(L₂).
If the test-piece is not assembled, the Examination Number must be indicated on each separate part of the test-piece.
- (b) Candidates are not permitted to communicate with or assist one another.
- (c) Write your Examination Number in the box provided on the examination paper - 2023. M74A(L₁).
- (d) Put the examination paper - 2023. M74A(L₁) and the test-piece into the candidate envelope supplied and hand up the envelope to the Superintendent at the end of the examination.

From the materials supplied, make the **Mechanism** shown on the drawings to the shape and dimensions specified.

PART	MATERIAL	PROCESS
3	Brass	Mark out, drill and shape.
6	U-Aluminium	Mark out, drill and shape.
8	Clear Polycarbonate	Mark out and shape.
9	Aluminium	Mark out, drill and shape.
10	Clear Polycarbonate	Mark out, drill and shape.

Note: (i) Parts 1, 2, 4, 5 and 7 have been made prior to examination day.
Using the threaded bar, screws and nuts supplied assemble the mechanism, as detailed on the assembly drawing.

(ii) **Accuracy, finish and function are important.**



Scrúdú na hArdteistiméireachta, 2023

Innealtóireacht - Praiticiúil
(150 marc)

Maidin: 10:00 go dtí 1:00 - Tráthnóna: 2:00 go dtí 5:00

Léigh na Treoracha seo go cúramach le do thoil

Treoracha

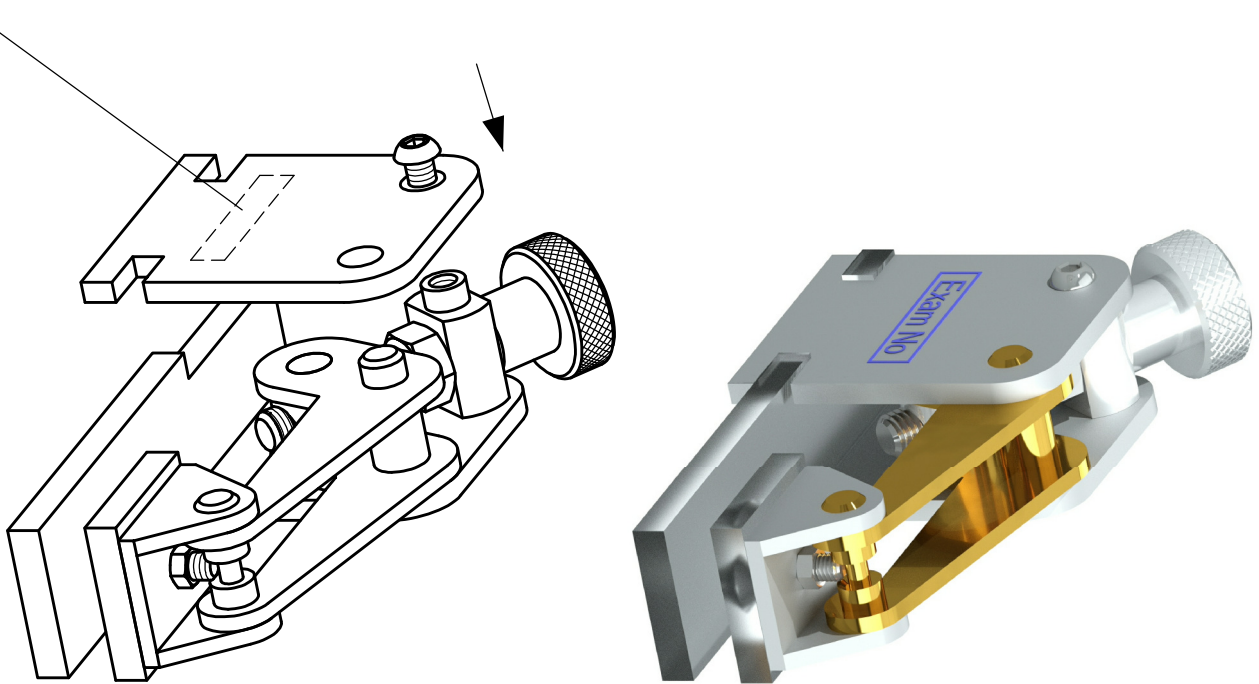
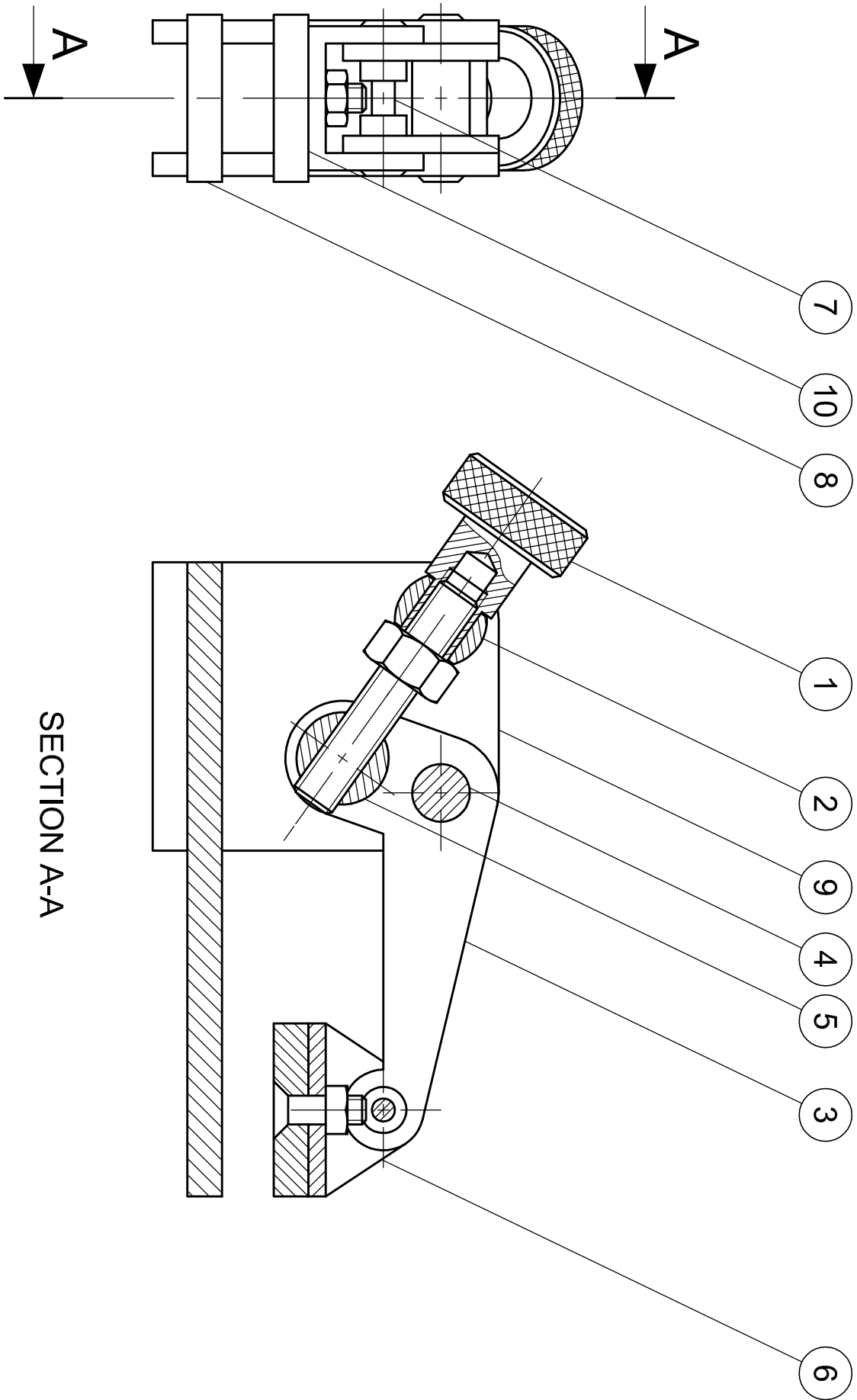
- (a) Ba chóir don **mhúinteoir** Scrúduimhir an iarrthóra a stampáil nó a ghreanadh ar an triailphíosa san ionad a thaispeántar ar an scrúdpháipéar - 2023. M74A(L₂). Mura bhfuil an triailphíosa curtha le chéile, ní mór an Scrúduimhir a thaispeáint ar gach páirt ar leith den triailphíosa.
- (b) Níl cead ag iarrthóirí a bheith i gcumarsáid le chéile ná cúnamh a thabhairt dá chéile.
- (c) Scríobh do Scrúduimhir sa bhosca atá ann di ar an scrúdpháipéar - 2023. M74A(L₁).
- (d) Cuir an scrúdpháipéar - 2023. M74A(L₁) agus an triailphíosa isteach i gclúdach an iarrthóra atá curtha ar fáil agus tabhair an clúdach don Fheitheoir ag deireadh an scrúdaithe.

As na hábhair a sholáthraítear, déan an **Mheicníocht** a thaispeántar sna líníochtaí sa chruth agus sna toisí a shonraítear.

PÁIRT	ÁBHAR	PRÓISEAS
3	Prás	A mharcáil amach, a dhruileáil agus a dheilbhiú.
6	U-Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
8	Polacarbónáit thrédhearcach	A mharcáil amach agus a dheilbhiú.
9	Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
10	Polacarbónáit thrédhearcach	A mharcáil amach, a dhruileáil agus a dheilbhiú.

Nóta: (i) Rinneadh na páirteanna 1, 2, 4, 5 agus 7 roimh lá an scrúdaithe.
Agus tú ag baint úsáide as an barra snáithe, na scriúnna agus na cnónna a sholáthraítear, cóimeáil an mheicníocht faoi mar atá sa líníocht chóimeála.

(ii) Tá tábhacht ag baint le cruinneas, le bailchríoch agus le hoibriú an triailphíosa.



ASSEMBLY DETAILS
SONRAÍ CÓIMEÁLA

THALL
OVER



Leaving Certificate Examination, 2023

Engineering - Practical (150 marks)

Morning: 10:00 to 1:00 - Afternoon: 2:00 to 5:00

Please Read Carefully

Instructions

- (a) The Examination Number must be clearly stamped or engraved, by the **teacher**, on the test-piece in the position indicated on the examination paper - 2023. M74A(L₂).
If the test-piece is not assembled, the Examination Number must be indicated on each separate part of the test-piece.
- (b) Candidates are not permitted to communicate with or assist one another.
- (c) Write your Examination Number in the box provided on the examination paper - 2023. M74A(L₁).
- (d) Put the examination paper - 2023. M74A(L₁) and the test-piece into the candidate envelope supplied and hand up the envelope to the Superintendent at the end of the examination.

From the materials supplied, make the **Mechanism** shown on the drawings to the shape and dimensions specified.

PART	MATERIAL	PROCESS
3	Brass	Mark out, drill and shape.
6	U-Aluminium	Mark out, drill and shape.
8	Clear Polycarbonate	Mark out and shape.
9	Aluminium	Mark out, drill and shape.
10	Clear Polycarbonate	Mark out, drill and shape.

Note: (i) Parts 1, 2, 4, 5 and 7 have been made prior to examination day.
Using the threaded bar, screws and nuts supplied assemble the mechanism, as detailed on the assembly drawing.

(ii) **Accuracy, finish and function are important.**



Scrúdú na hArdteistiméireachta, 2023

Innealtóireacht - Praiticiúil
(150 marc)

Maidin: 10:00 go dtí 1:00 - Tráthnóna: 2:00 go dtí 5:00

Léigh na Treoracha seo go cúramach le do thoil

Treoracha

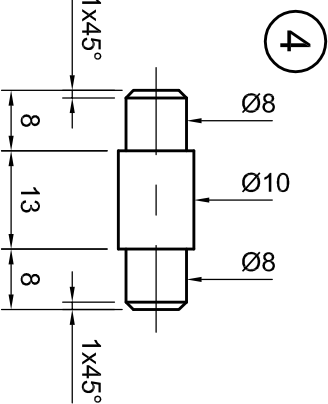
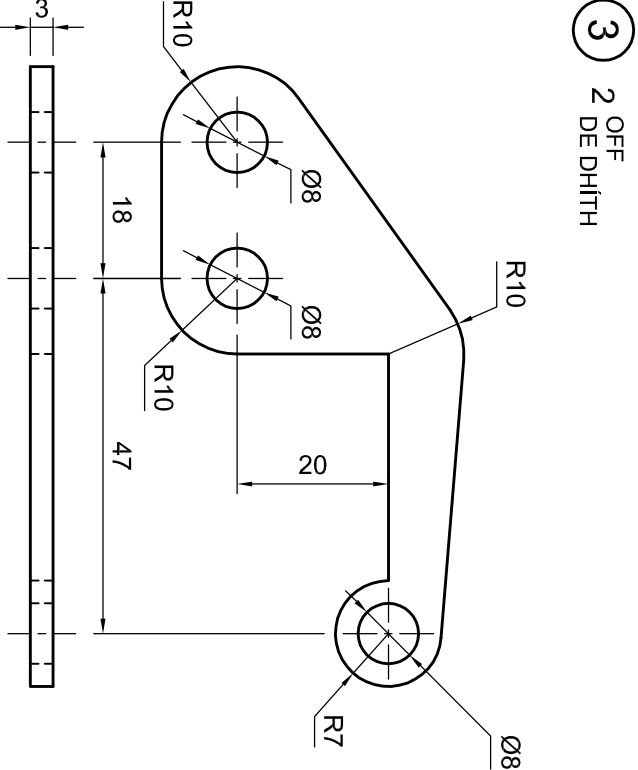
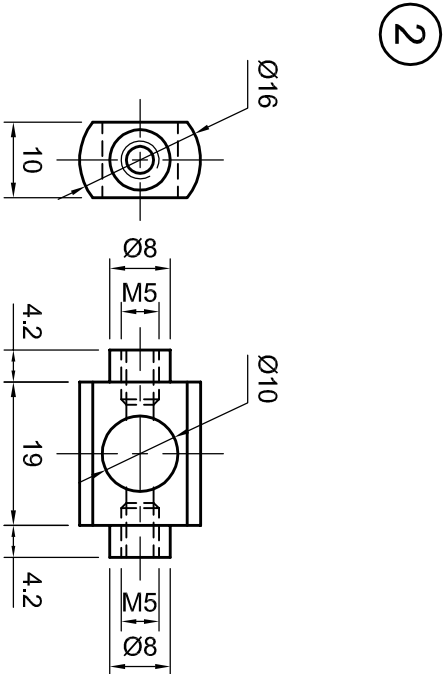
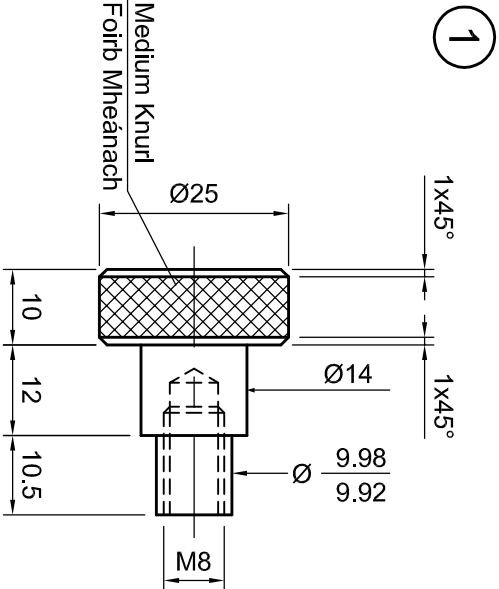
- (a) Ba chóir don **mhúinteoir** Scrúduimhir an iarrthóra a stampáil nó a ghreanadh ar an triailphíosa san ionad a thaispeántar ar an scrúdpháipéar - 2023. M74A(L₂). Mura bhfuil an triailphíosa curtha le chéile, ní mór an Scrúduimhir a thaispeáint ar gach páirt ar leith den triailphíosa.
- (b) Níl cead ag iarrthóirí a bheith i gcumarsáid le chéile ná cúnamh a thabhairt dá chéile.
- (c) Scríobh do Scrúduimhir sa bhosca atá ann di ar an scrúdpháipéar - 2023. M74A(L₁).
- (d) Cuir an scrúdpháipéar - 2023. M74A(L₁) agus an triailphíosa isteach i gclúdach an iarrthóra atá curtha ar fáil agus tabhair an clúdach don Fheitheoir ag deireadh an scrúdaithe.

As na hábhair a sholáthraítear, déan an **Mheicníocht** a thaispeántar sna líníochtaí sa chruth agus sna toisí a shonraítear.

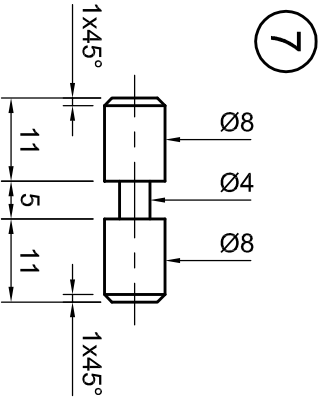
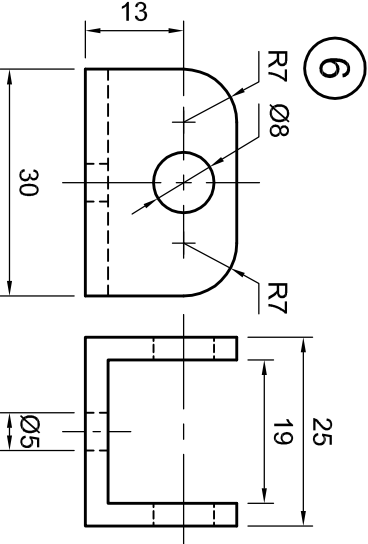
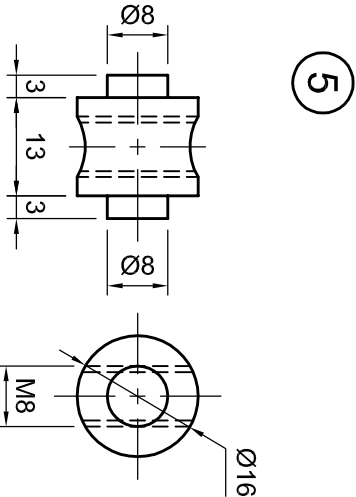
PÁIRT	ÁBHAR	PRÓISEAS
3	Prás	A mharcáil amach, a dhruileáil agus a dheilbhiú.
6	U-Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
8	Polacarbónáit thrédhearcach	A mharcáil amach agus a dheilbhiú.
9	Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.
10	Polacarbónáit thrédhearcach	A mharcáil amach, a dhruileáil agus a dheilbhiú.

Nóta: (i) Rinneadh na páirteanna 1, 2, 4, 5 agus 7 roimh lá an scrúdaithe.
Agus tú ag baint úsáide as an barra snáithe, na scriúnna agus na cnónna a sholáthraítear, cóimeáil an mheicníocht faoi mar atá sa líníocht chóimeála.

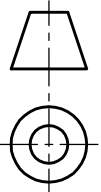
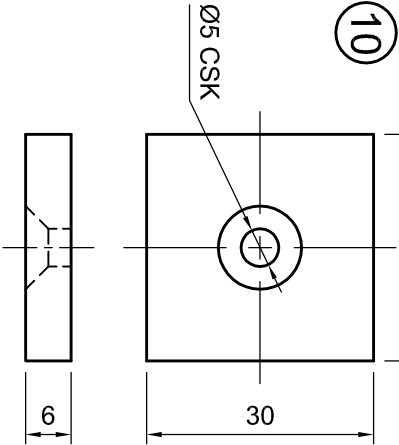
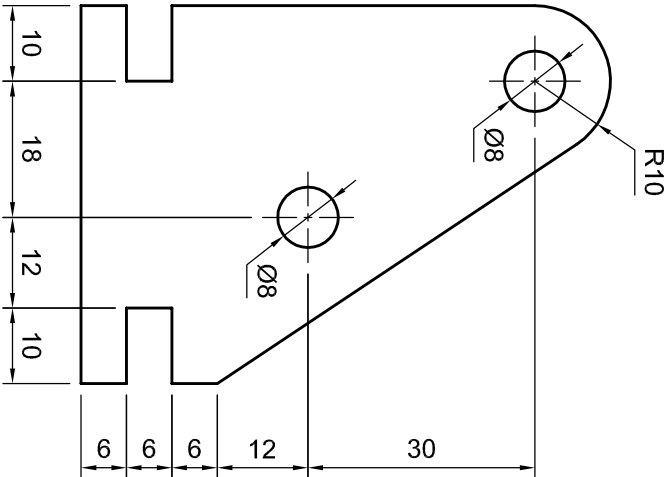
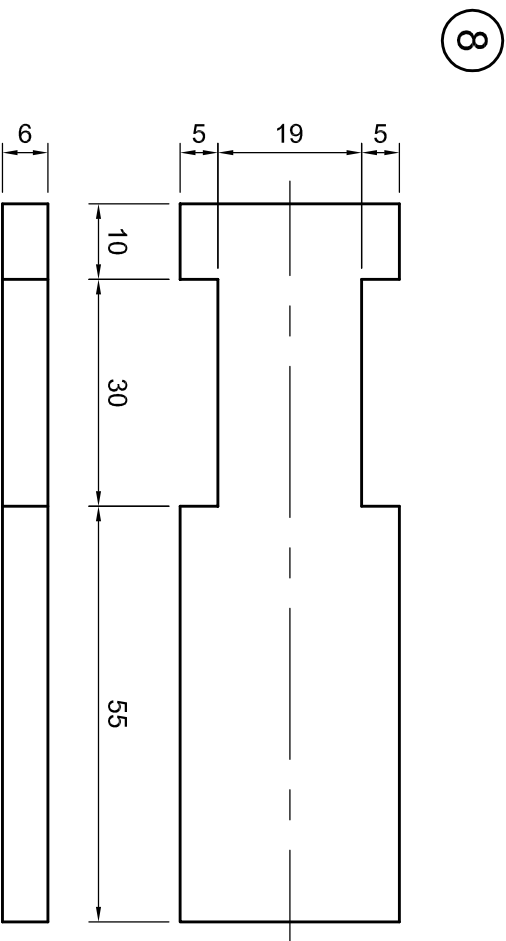
(ii) Tá tábhacht ag baint le cruinneas, le bailchríoch agus le hoibriú an triailphíosa.



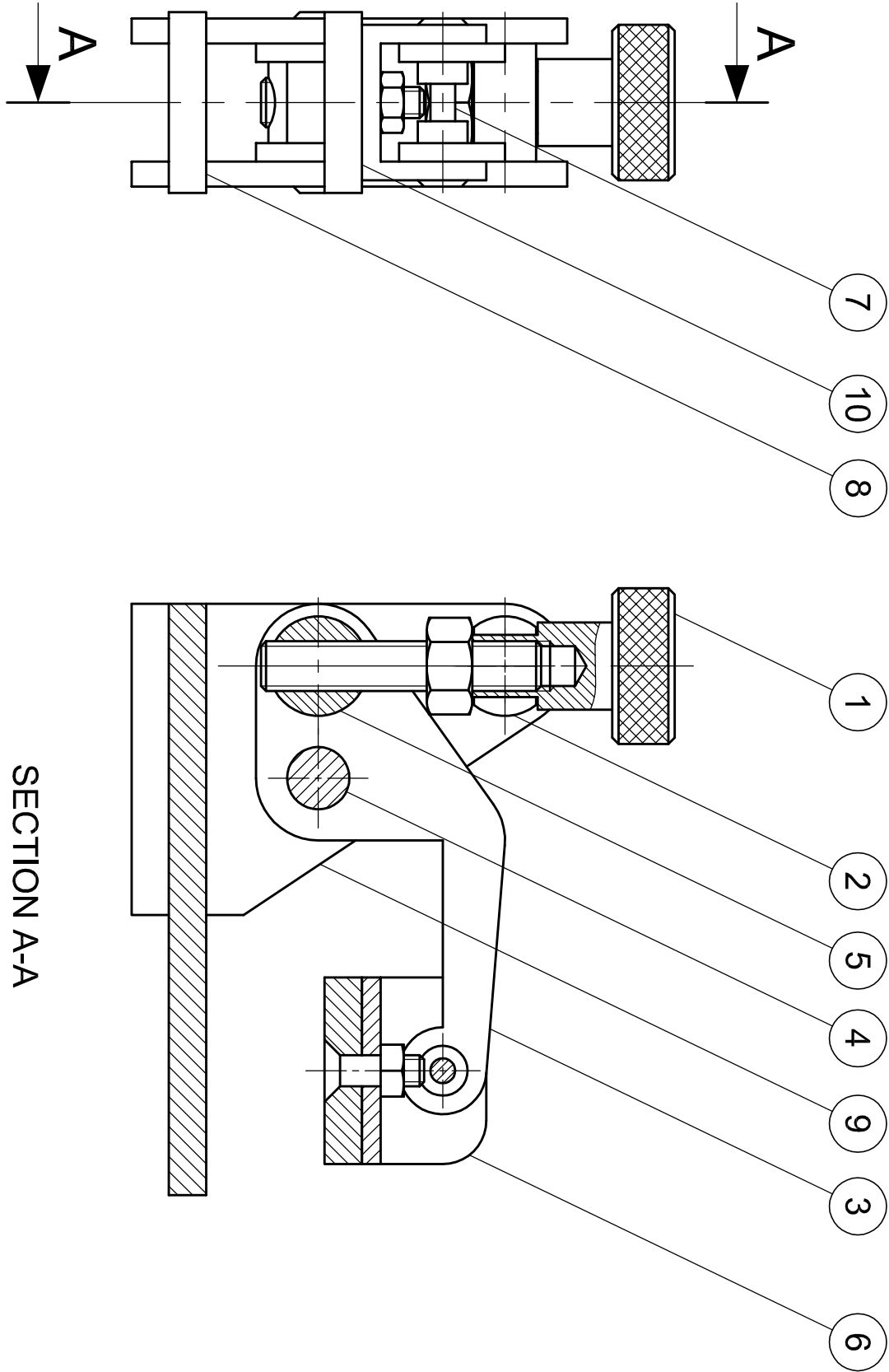
Cuir an scrúdpháipéar seo agus an triailphíosa isteach i gclúdach an iarthóra
atá curtha ar fáil, agus tabhair an clúdach don Fheitheoir ag deireadh an scrúdaithe.
Put this examination paper and the test-piece into the candidate envelope supplied,
and hand up the envelope to the Superintendent at the end of the examination.



Scriobh do Scrúdumhir sa bhosca seo:
Write your Examination Number in this box:

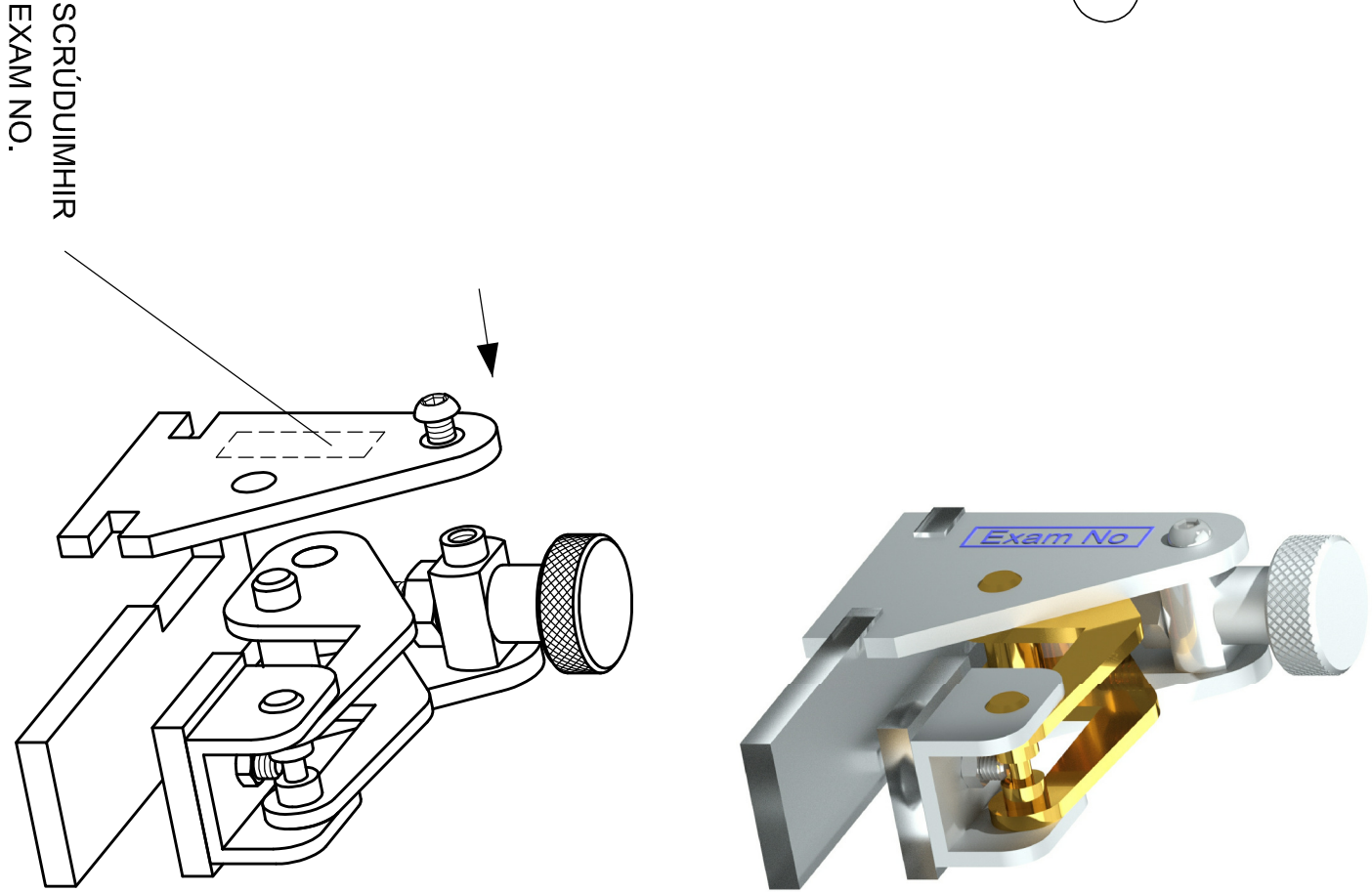


THALL
OVER



SECTION A-A

ASSEMBLY DETAILS
SONRAÍ CÒIMEÁLA



THALL
OVER