CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

16 MAY 2017 (a.m.)

M1701373020

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE | 0 | 1 | 3 | 7 | 3 | 0 | 2 | 0 |

SUBJECT INDUSTRIAL TECHNOLOGY
OPTION B – MECHANICAL ENGINEERING TECHNOLOGY – Paper 02

PROFICIENCY TECHNICAL

REGISTRATION NUMBER | | | | | | | | | | |

SCHOOL/CENTRE NUMBER					

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CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH | D | D | M | M | Y | Y | Y | Y |

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0137302001

DO NOT WRITE ON THIS PAGE

0137302002

FORM TP 2017077

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MAY/JUNE 2017

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

INDUSTRIAL TECHNOLOGY

OPTION B – MECHANICAL ENGINEERING TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of FIVE compulsory questions.
2. Use sketches where necessary to support your answers.
3. Write your answers in the spaces provided in this booklet.
4. Do NOT write in the margins.
5. You may use a silent, non-programmable calculator to answer questions.
6. This paper contains metric dimensions only. You should work your answers in the metric system.
7. You are advised to take some time to read through the paper and plan your answers.
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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0137302003

1. Figure 1 shows a traditional shovel which consists of a fixed scoop, shank and handle. The storage and transportation of shovels require a substantial amount of space. The aim is to redesign the traditional shovel to obtain a portable, foldable or collapsible tool. The redesigned shovel should return to its original dimension of 600 mm × 150 mm when open for use.

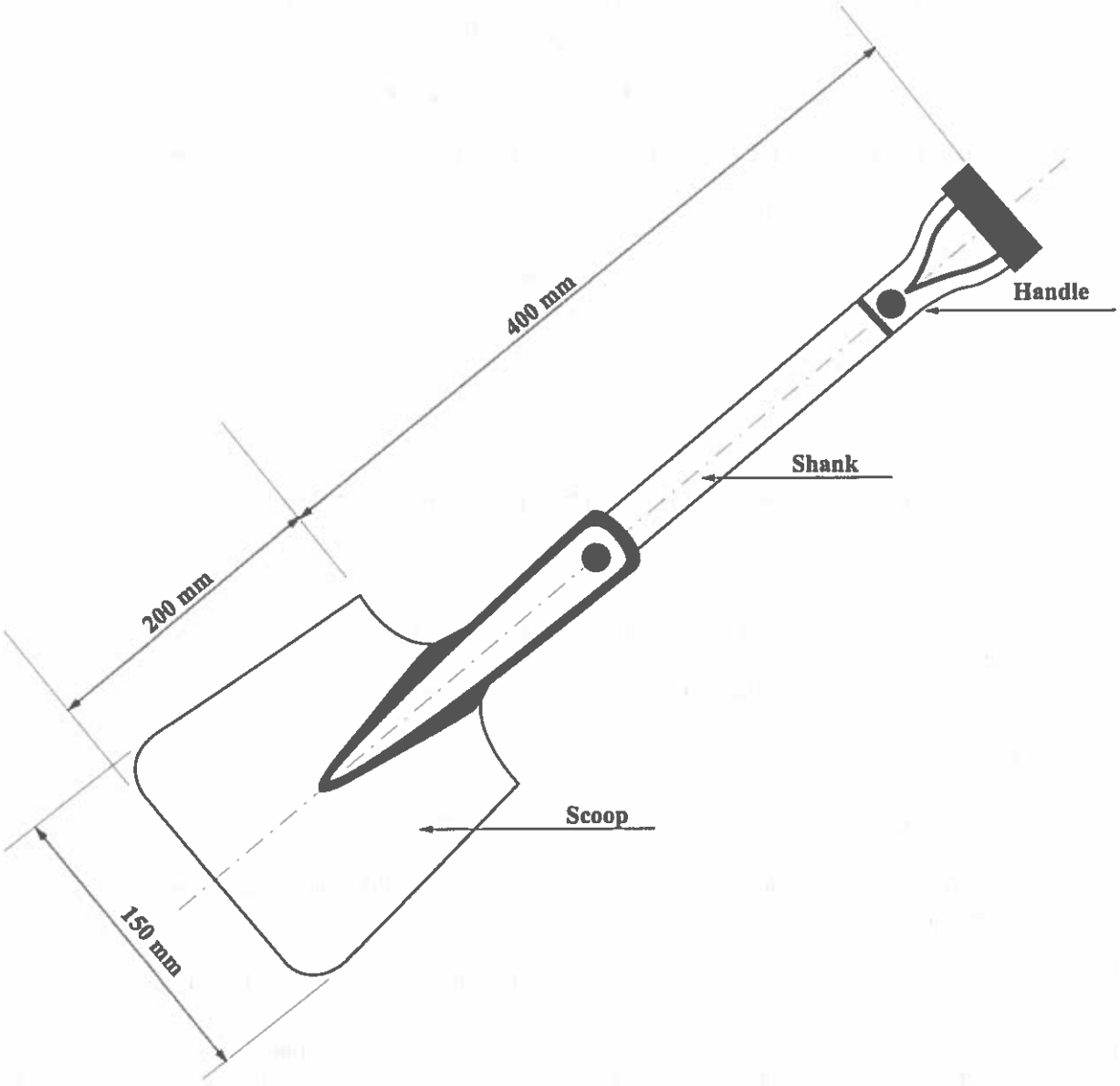


Figure 1. Traditional shovel

Specifications:

- The totally collapsed or folded shovel will occupy a space of 200 mm × 150 mm.
- The shank is to be made from 50 mm diameter solid aluminium rod.
- The scoop is to be made from 10 gauge sheet steel.
- The handle is to be made from 25 mm solid steel bar.
- The shovel must be foldable or collapsible without disassembling.
- The design should facilitate quick folding and unfolding of the shovel.
- The shovel should fold and unfold with the use of the hands and no additional tools.

Complete the design of the shovel to meet the specifications given and use sketches to show the following:

(a) A means of connecting the shank to the scoop without the use of welding

(6 marks)

(b) A method of allowing the shank-scoop assembly to be tightened in the working position of the shovel, and loosened to collapse or fold the shovel

(6 marks)

(c) A means of securely connecting the shank to the handle.

(6 marks)

Total 18 marks

GO ON TO THE NEXT PAGE

2. Figure 2 shows a judge's gavel which is to be produced on the centre lathe. The gavel is to be made from aluminium: the head is to be made from a piece 50 mm diameter by 120 mm long, and the handle from a piece 25 mm diameter by 240 mm long.
(NB: The threads are to be produced by hand.)

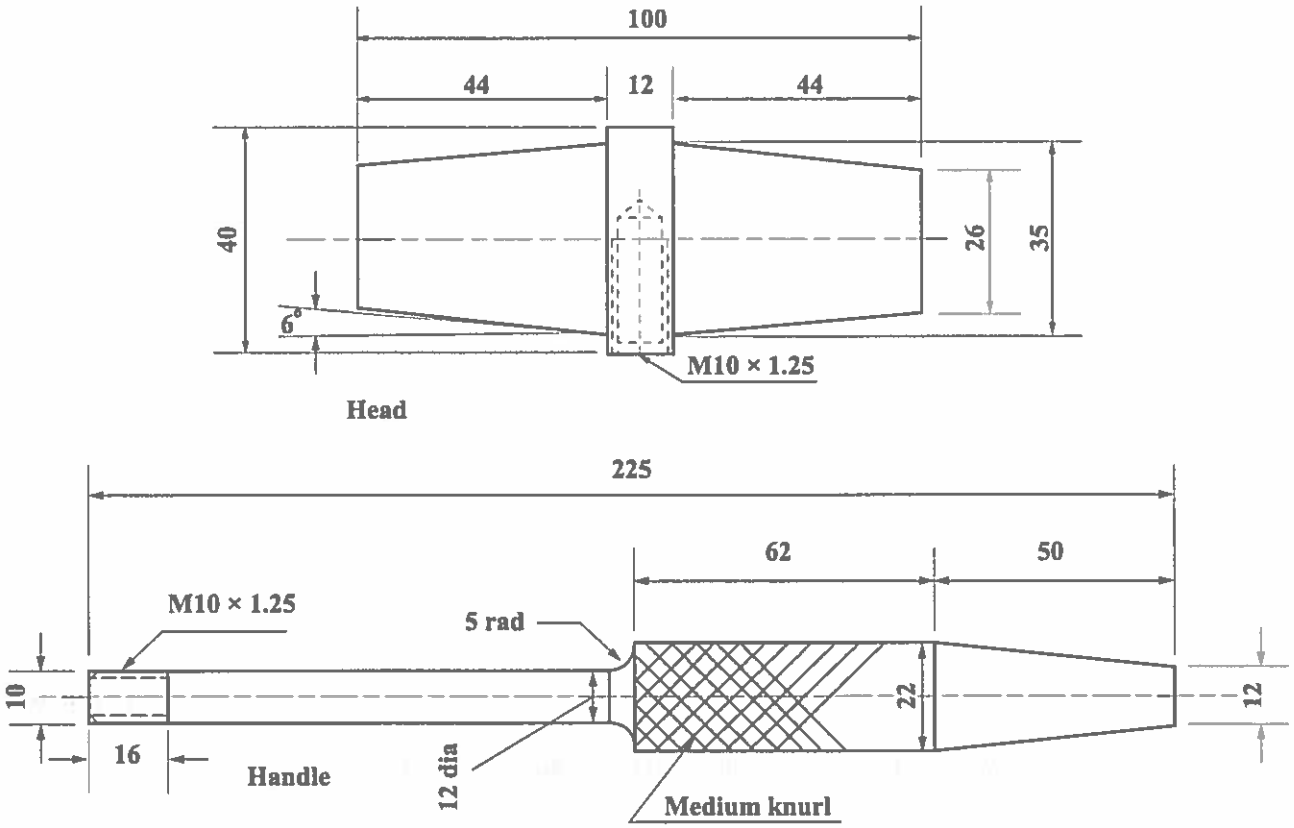


Figure 2. Judge's gavel

(a) Outline the steps of procedure required to produce the gavel.

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(6 marks)

(b) Name TWO tools which can be used to produce the gavel.

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(2 marks)

(c) Describe a method to produce the 50 mm long tapered section of the handle of the gavel.

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(2 marks)

(d) During the lathe turning operation, the following problems were observed:

- The tool was rubbing and not cutting the work.
- The work was climbing over the tool.
- The tool was chattering.
- The tool became dull frequently.

(i) State ONE cause EACH for any TWO of the problems listed in (d).

Problem	Cause
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(2 marks)

(ii) State ONE remedy for EACH of the causes stated in (d) (i).

Cause	Remedy
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(2 marks)

GO ON TO THE NEXT PAGE

(e) State TWO main functions of cutting fluids.

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(2 marks)

(f) What are the TWO axes that should be used if the gavel was to be produced on a Computer Numerical Control lathe?

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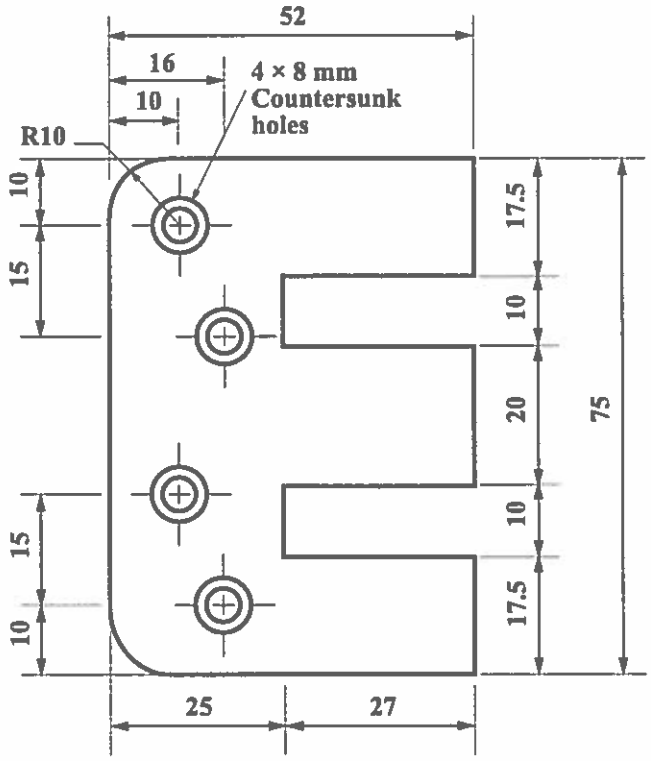
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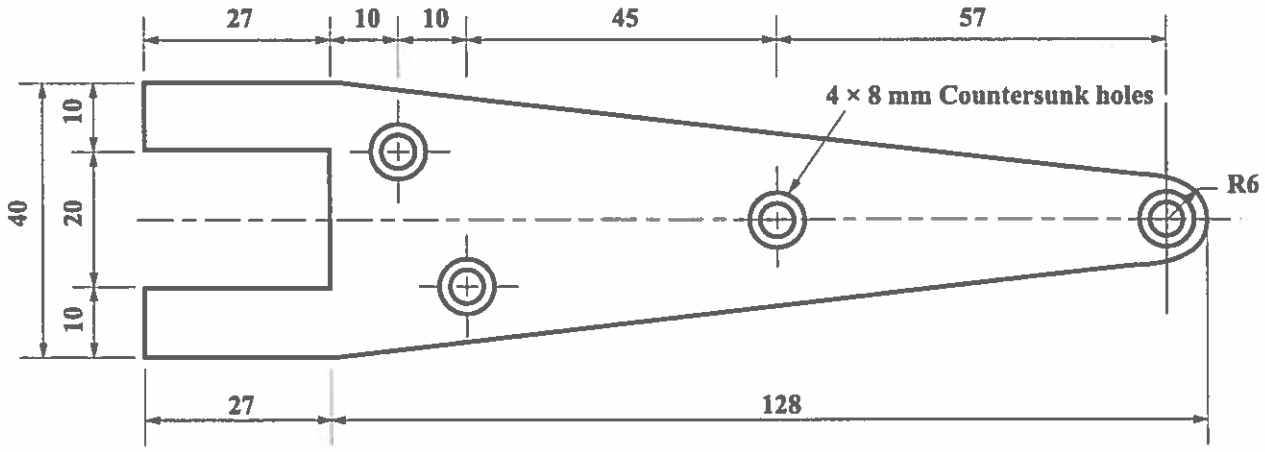
(2 marks)

Total 18 marks

3. Figure 3 shows the components which make up a cross-garnet hinge. The hinge is to be produced from 10 gauge black iron. The vertical leaf is 52 mm wide and 75 mm long. The horizontal strap is 40 mm wide and 155 mm long.



Vertical leaf



Horizontal strap

Figure 3. Components of a cross-garnet hinge

(a) Outline the steps of procedure for marking out the horizontal strap of the hinge.

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(4 marks)

(b) Name TWO tools that can be combined to completely mark out the horizontal strap in (a).

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(2 marks)

(c) For the given hinge:

(i) Use a sketch to illustrate a method for cutting out ONE of the slots in either the vertical leaf or the horizontal strap.

(2 marks)

(ii) Outline the steps of procedure for drilling and countersinking the holes.

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(2 marks)

(d) Name TWO tools which can be used for cutting out the slots.

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(2 marks)

(e) Name TWO tools and equipment which can be used to produce the countersunk holes.

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(2 marks)

(f) The horizontal strap needs to be cut using an oxyacetylene flame. List the steps of procedure for producing a cutting flame.

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(4 marks)

Total 18 marks

4. Figure 4 shows a pictorial view of a dustpan, 250 mm long by 250 mm wide by 75 mm high, with a safe edge at the top. The dustpan is made from 16 gauge galvanized steel sheet.

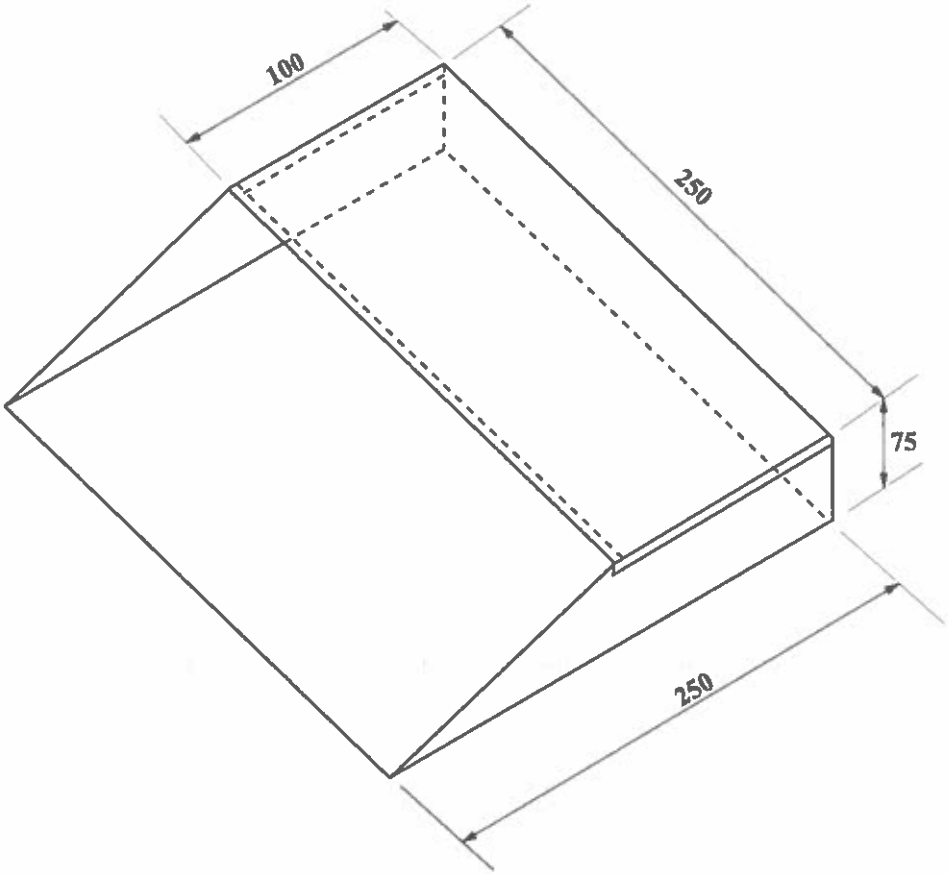


Figure 4. Dustpan

(a) Draw the layout of the dustpan showing all bends and folds.

(4 marks)

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(b) Outline the steps of procedure to be used to complete the dustpan.

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(6 marks)

(c) Name TWO other materials which can be used to make the dustpan.

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(2 marks)

(d) Describe the method that should be used to solder the top of the dustpan to the sides.

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(3 marks)

(e) Calculate the width of the material needed for the lap to join the top of the dust pan to the sides. Note: 16 gauge = 1.5 mm.

(2 marks)

(f) State ONE safety precaution which should be observed when carrying out the joining process.

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(1 mark)

Total 18 marks

5. Figure 5 shows a piece of decorative bar, which is to be made from ½ inch square solid bar stock.



Figure 5. Decorative bar

(a) With the aid of sketches, describe the steps of procedure for producing the decorative bar.

(6 marks)

(b) The decorative bar in Figure 5 is to be used to fabricate a railing using the arc welding method. With the aid of a sketch, explain the procedure for striking an arc before starting the welding process.

(4 marks)

(c) Illustrate, with a labelled sketch, a simple gear train showing the driver, the driven and the idle gears.

(2 marks)

(d) Name TWO substances that are used to keep gears in good working order.

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(2 marks)

(e) Table 1 shows a list of engineering materials and characteristics. For EACH type of material, indicate by using a tick (√), the appropriate characteristic.

TABLE 1: ENGINEERING MATERIALS AND CHARACTERISTICS

Name of Material	Weight		Conductivity	
	Heavy	Light	Good	Poor
Nylon				
Brass				
Rubber				
Aluminium				

(4 marks)

Total 18 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. ☐

EXTRA SPACE

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TEST CODE: | 0 | 1 | 3 | 7 | 3 | 0 | 2 | 0 |

SUBJECT: INDUSTRIAL TECHNOLOGY
OPTION B – MECHANICAL ENGINEERING TECHNOLOGY – Paper 02

PROFICIENCY: TECHNICAL

REGISTRATION NUMBER: | | | | | | | | | | |

FULL NAME: _____
(BLOCK LETTERS)

Signature: _____

Date: _____

2. **Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.**

3. **Keep it in a safe place until you have received your results.**

INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: _____
Supervisor/Invigilator

Date: _____