



**JUNE XXXX**

**INTERMEDIA**

Subject Title	<b>MATERIAL SCIENCE AND PROCESSES</b>
Subject Code No.	<b>5385</b>
Paper No.	<b>THREE</b>

**THREE HOURS**

**INSTRUCTIONS**

This paper is practical. It is carried out in a Manufacturing Mechanical workshop equipped with Shaping of metal, Heat Treatment and Testing of Metal equipment with their respective control instruments.

The paper consists of three dependent phases as follows:

**Phase 1: Preparation – 20 minutes;**

**Phase 2: Heating and Shaping of Metal – 1 hour;**

**Phase 3: Heat Treatment of Metal – 1 hour;**

**Phase 4: Mechanical Testing of Metal – 20 minutes;**

**Phase 5: Final Report Writing – 20 minutes.**

*You are reminded to respect the safety rules and regulations of the workshop.*

At the end of the paper, hand in the piece(s) realized and the report of the processes to the examiner(s).

**You are reminded of the necessity for good English and orderly presentation in your answers.**

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*Turn Over*

A rough flat bar of 140 x 30 x 3 in S 235 is placed at your disposal to realize a **Kitchen Knife** as shown in figure 1 below.

## WORK TO BE DONE

### PHASE 1 - PREPARATION:

(5 marks)

- Procedure(s):
  - a) Punch or file or cut to 5 mm depth or bench or grind, rough workpiece
  - b) Report writing on one of the above operations.

### PHASE 2 – HEATING AND SHAPING OF METAL:

(16 marks)

- Procedure(s):
  - a) Heat the rough piece to forging temperature (reddish colour);
  - b) Control temperature;
  - c) Hammer the heated edge to the required shape as indicated in figure;
  - d) Control of dimensions obtained.

### PHASE 3 – HEAT TREATMENT OF METAL

(14 marks)

- Procedure(s):
  - a) Heating the whole finished workpiece to hardening temperature,
  - b) Quenching in cooling medium,
  - c) Reheating to whole workpiece to tempering temperature,
  - d) Cooling
  - e) Testing of hardness: (Punching or filing or grinding or bending or cutting).
  - f) Control of dimensions.

### PHASE 4 – TESTING OF METAL

(10 marks)

- Procedure(s):
  - a) Testing of hardness: (Punching or filing or grinding or bending or cutting).

### PHASE 5 – FINAL REPORT WRITING

(5 marks)

- a) Final report writing on the above processes (1 to 4).

### KITCHEN KNIFE

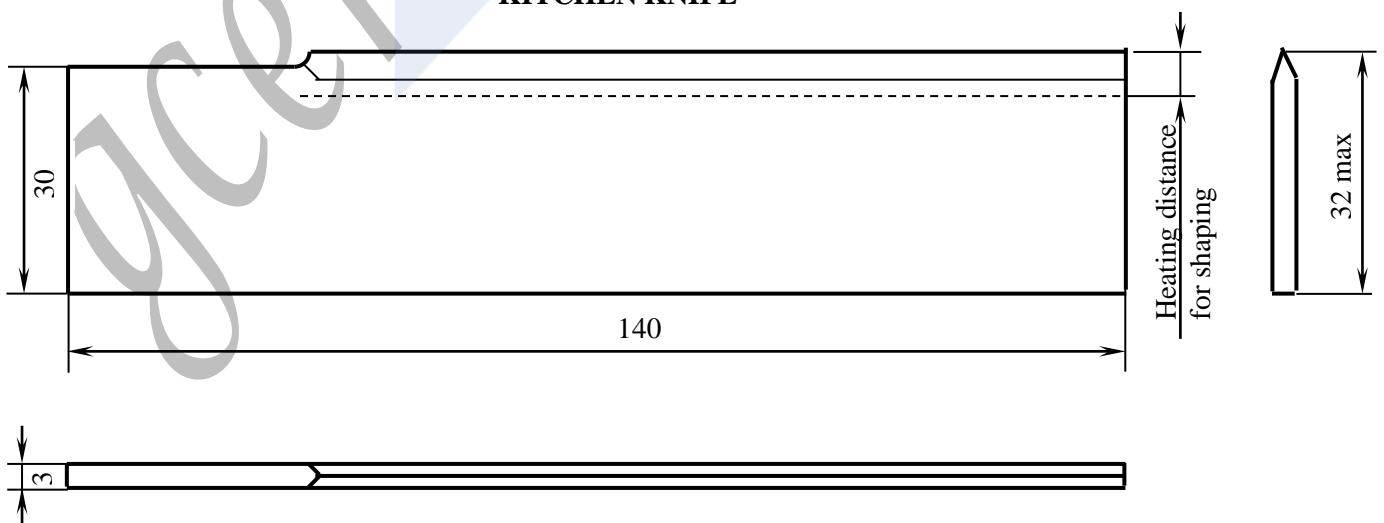


Figure 1

**MATERIAL SCIENCE AND PROCESSES 3**  
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**INTERMEDIATE LEVEL**

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**ADVANCED INFORMATION**

**LIST OF MATERIALS TO BE GIVEN TO CANDIDATES.**

- Flat bar of 120 x 15 x 5 in S 235 per candidate

**WORKSHOP EQUIPEMENT AND TOOLS**

- A set of oxy-acetylene gas;
- Table vices;
- Hammers;
- Steel rules;
- Vernier calipers
- Pliers;
- Tongs;
- Anvils;
- Punches;
- Charcoal.

**LISTS OF MATERIALS TO BE BROUGHT BY CANDIDATES**

- Overall;
- Helmets;
- Safty boots;
- Googles;
- Leather gloves;
- Noise protector;
- Steel rules;

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**MAKING GUIDE**

PHASES	ITEMS	MARKS	SCORE	REMARKS
PREPARATION	Punch or file or cut to 5 mm depth or bench or grind, rough workpiece	2.5		
	Report writing on one of the above operations.	2.5		
HEATING AND SHAPING OF METAL	Heat the rough piece to forging temperature (reddish colour);	3		
	Control of temperature	6		
	Hammer the heated edge to the required shape as indicated in figure	3		
	Control of dimensions obtained	4		
HEAT TREATMENT OF METAL	Heating the whole finished workpiece to hardening temperature	3		
	Quenching in cooling medium,	2		
	Reheating to whole workpiece to tempering temperature,	2		
	Cooling	3		
	Testing of hardness: (Punching or filing or grinding or bending or cutting).	2		
	Control of dimensions.	2		
TESTING OF METAL	Testing of hardness: (Punching or filing or grinding or bending or cutting)	10		
FINAL REPORT WRITING	Testing of hardness: (Punching or filing or grinding or bending or cutting).	5		
<b>TOTAL</b>		<b>50</b>		