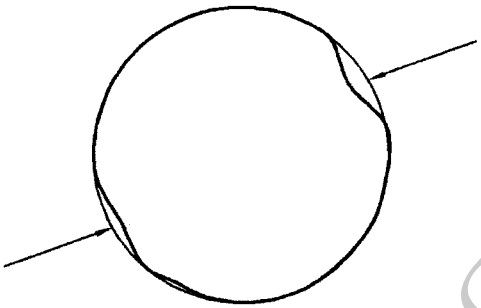
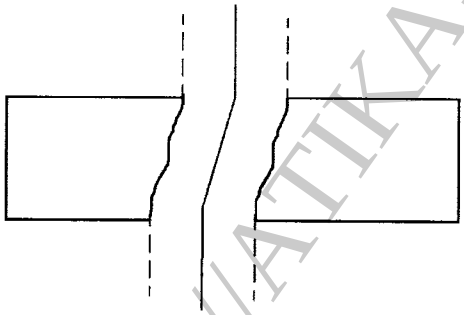
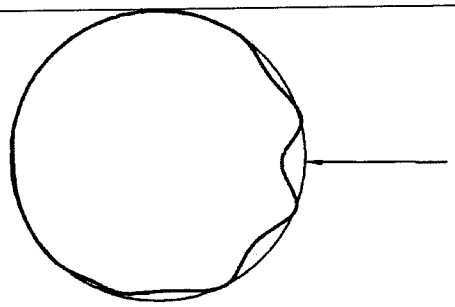
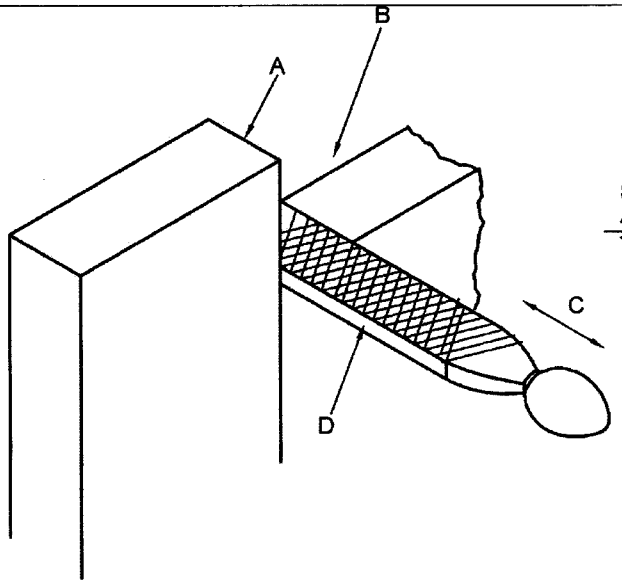
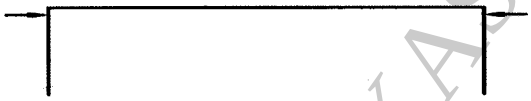
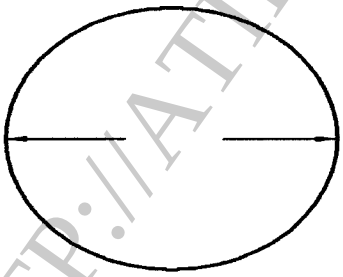
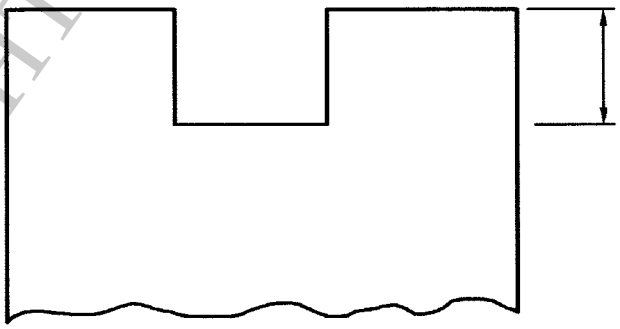
4.17 METALWORK (445)

4.17.1 Metalwork Paper 1 (445/1)

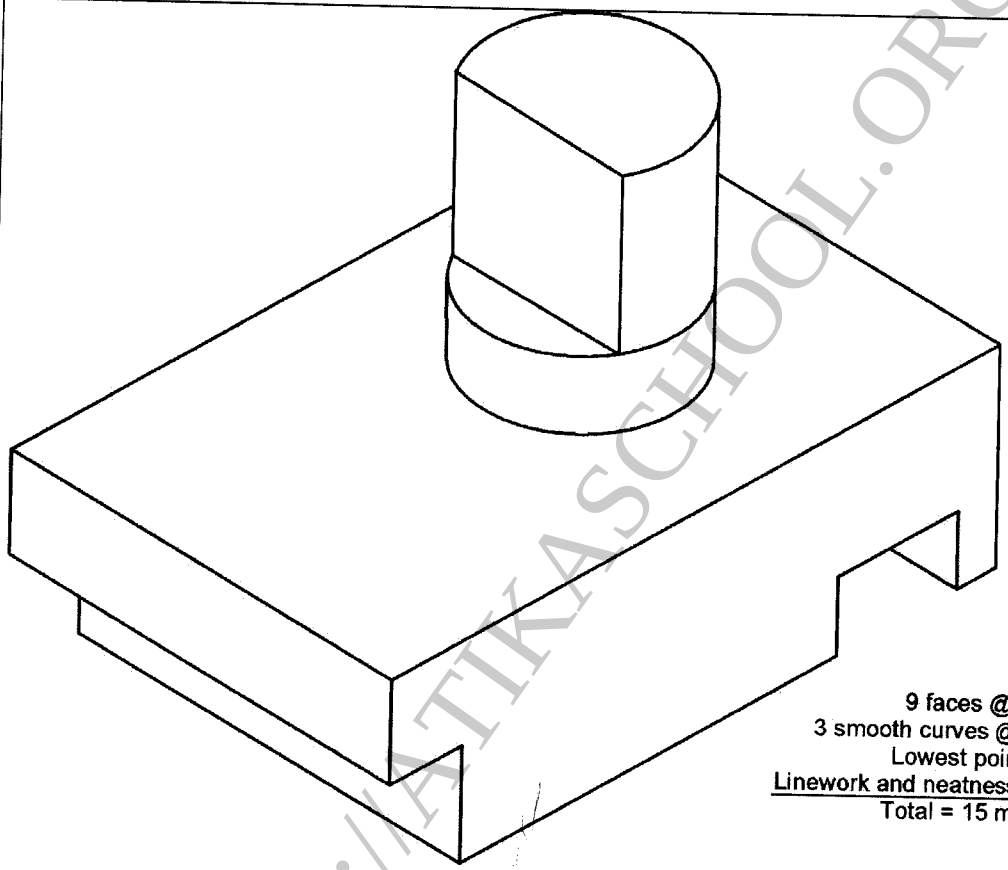
1.	a) An entrepreneur is a person who starts and runs/manages a business	**(1 mark)**
	b) Two business opportunities in the field of metalwork are: – Making of metallic items e.g. frames – Selling of metallic materials – Recycling of metals – Welding and fabrication **Any 2 x ½ =**	**(1 mark)**
2.	a) Causes of burns in a workshop – Naked flame – Leaking steam – Acids – Hot metals – Hot water – Hot air **Any 2 x 1 =**	**(2 marks)**
	b) Safety precautions during heat treatment of steel; – Always wear correct attire i.e. gloves, shields, leather, aprons etc – Use tongs to handle hot metal – Always label hot metals or areas where they are kept. – Do not overheat the metals. **Any 2 x 1=**	**(2 marks)**
3.	a) i. Surface finish required ii. Strength of the riveted joint iii. Thickness of the material iv. Function of the finished articles **Any 4 x 1/2=**	**(2 marks)**

	b) Factors to consider when selecting spelter; i. Thickness of the material being brazed. ii. The design of the joint. iii. The method of heating the metals. iv. Type of material. **Any 3 x 1=**	**(3 marks)**
4.	Faults in a drilled hole; i. Uneven hole finish Cause – loose workpiece while drillimg  ii)  Cause – Loose workpiece while drilling – Improper fixing of workpiece onto the vice while drilling	

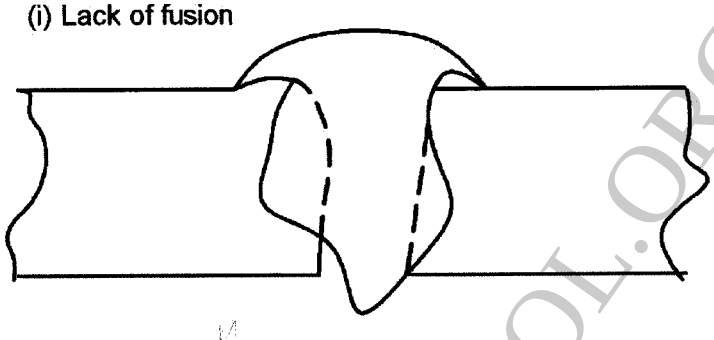
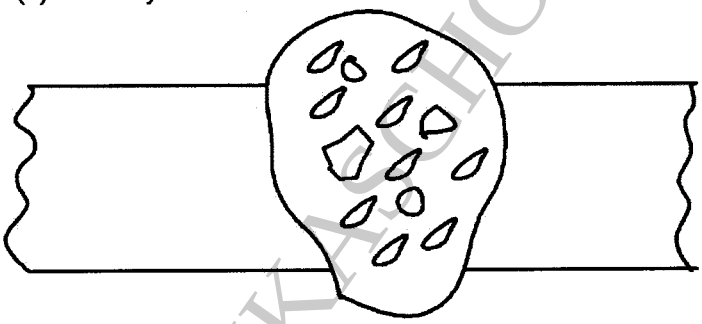
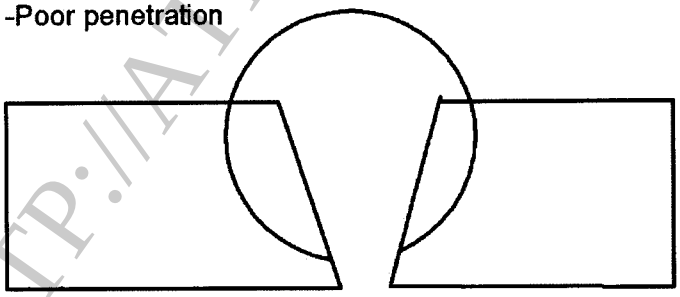
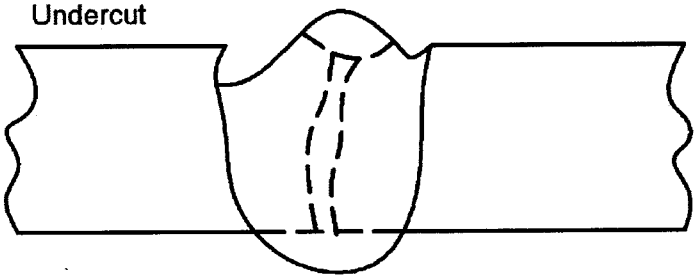
	 – Cause: worn out drill – Accept any other correct fault shown **Sketches Any 2 x 1 = 2** **Causes Any 2 x 1 =2**		**(4 marks)**
5.	**Material** a) Aluminium alloys b) Copper c) Mild steel d) Cast iron	**Properties** – Light in weight – Non corrosive to water and common liquids – Good conductor of electricity – Easy to cut/form – Resistant to wear – Self lubricating – Easy to cast **Properties 4 x 1= 4 marks**	**(4 marks)**
	– Aluminium – Copper – Mild steel – Cast iron	**Uses** – Making aircraft bodies – Making of kitchen utensils – Making engine blocks – Used in making electricity cables – Making of furniture – Making of engine blocks – Making surface plates **Any 4 x ½ = 2**	**(2 marks)**

6.	 Sketch = 2 4 labels ×1=2 TOTAL = 4 MARKS **Sketch = 2 marks** **4 labels x ½ =2 marks**	**(4 marks)**
7.	Three different dimensions which can be taken using a Vernier caliper (i) Length  (ii) Diameter  (iii) Depth  3×1= 3 Marks	**(3 marks)**

8.	a) Methods of holding a workpiece on a lathe machine By use of i. Chucks ii. Catch plates iii. Face plates iv. Between Centres v. Steadies **Any 4 x ½ =**	**(2 marks)**
	b) Functions of parts of a lathe machine: i. Bed – Provides a frame for the tailstock and carriage to move along. ii. Carriage – Carries and controls the movement of the machine tool iii. Headstock – Carries the gears for changing the speed of the spindle. **3 x 1 =**	**(3 marks)**
9.	a) Reasons for finishing workpieces: i. To protect the item from corrosion ii. To attain a particular specification iii. For aesthetic purpose **Any 2 x 1=**	**(2 marks)**
	b) Types of finishes – Coating – Painting – Burning – Lacquering – Bluing – Oil blacking – Polishing **Any 2 x ½ =**	**(1 mark)**

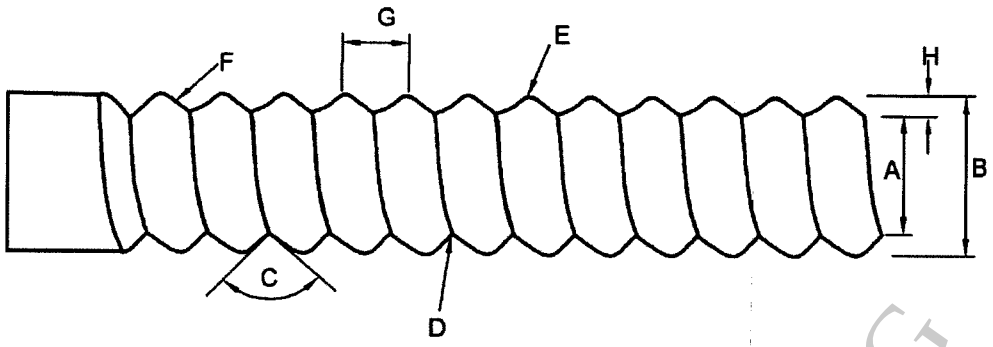
10.	Use of tools in sheet metal work Bick - Support work when shaping tapered work. Funnel stake - Supporting and shaping cylindrical works Half Moon stake - Holding curved edges when wiring or making bottoms. Soft Hummers - For hammering light blows on sheet metals. **4 x 1=**	**(4 marks)**
11.	 9 faces @ 1=9 3 smooth curves @1=3 Lowest point =1 Linework and neatness = 2 Total = 15 marks	**(15 marks)**

12.	a) Safety rules when turning between centres i. Do not overtighten the tailstock centre ii. Lock the dog properly iii. Hold the work firmly **Any 2 x 1=**	**(2 marks)**
	b) Factors which determine the rate of material removal i. Size of workpiece Large workpiece require slower running speed therefore a slower rate of material removal. ii. Shape of material/workpiece Irregular shaped workpieces have to be cut as small pieces at a time i.e. at a slow rate. iii. Machine speed For slower machine speeds, the tool feed should be slower for high rate of material removal. iv. Different tasks require different rates of material removal e.g. knurling should be slower than turning. **Factors 4 x ½ = 2marks** **Explanations 4 x 1 = 4 marks**	**(6 marks)**
	c) – Face the workpiece – Centre drill the face – Fix the drill chuck on the tailstock – Fit the twist drill onto the chuck. – Move the tailstock close to the workpiece and lock it in position. – Feed the twist drill to the rotating work using the tailstock handwheel. **Any 5x1**	**(5 marks)**

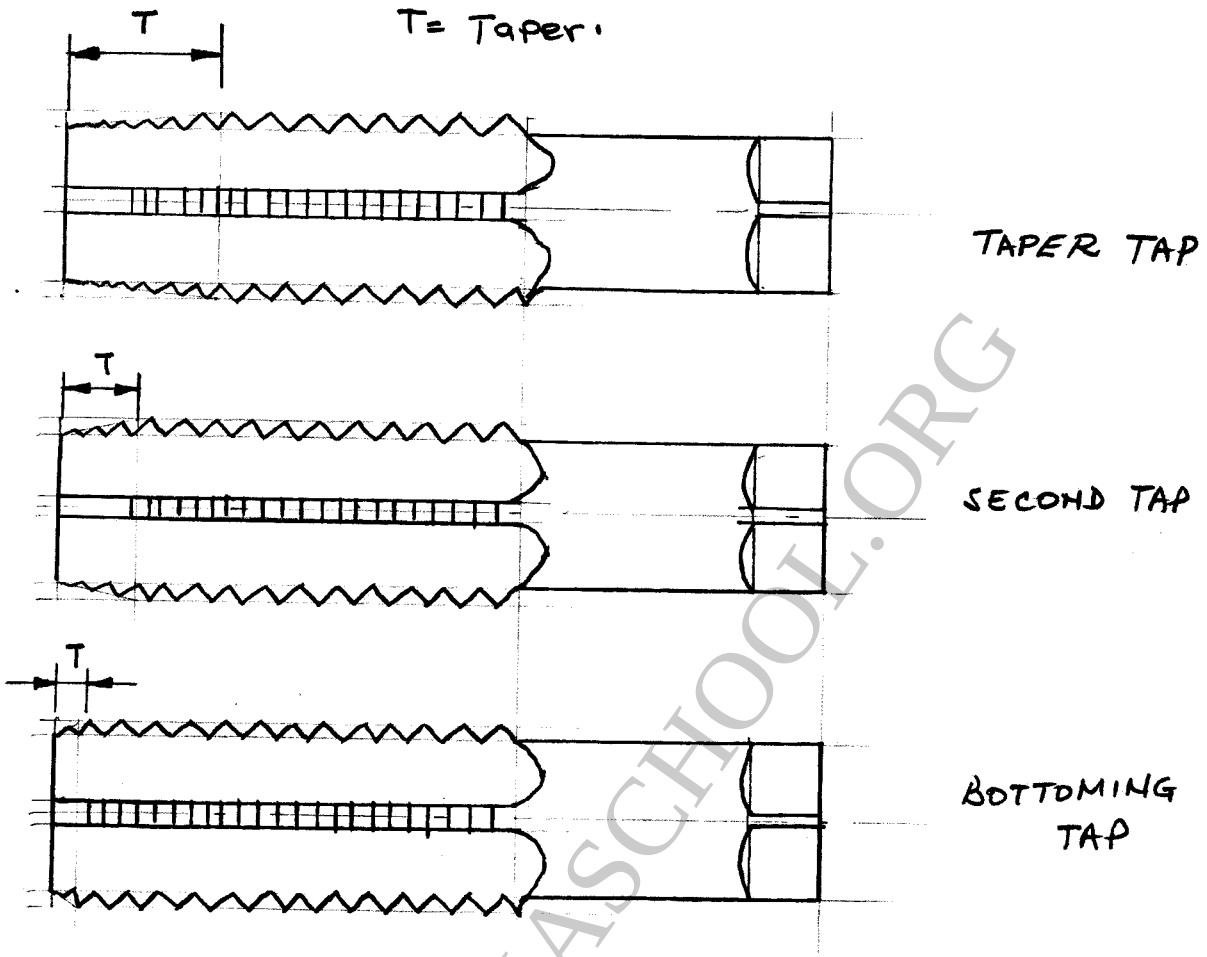
	d) Limitations of using a three jaw chuck: i. Cannot correctly hold irregular workpieces ii. Not easy to grip to maximum iii. Difficult to use when offset (eccentric) turning **Any 2 x 1=**	**(2 marks)**
13.	a) Welding defects (i) Lack of fusion  (b) Porosity  -Poor penetration  Undercut 	

	– **Lack of fusion** This is the incomplete mixing of the base metal and filler rod. – **Porosity** This is the crack or break in the joint, caused by gases being trapped in the weld. – **Poor penetration** The base metal is not fully fused at all points of the joint. – **Undercut** The melting of the base metal at the edges of the weld joint. **Sketches (4x1) = 4** **Descriptions (4x1/2) = 2**	**6 marks**
	b. Possible causes – Lack of fusion ✓ Failure to remove oxides from parent metal. ✓ Lack of enough heat to melt the parent metal. – Porosity ✓ Excessive moisture in the electrode or joint ✓ Oil paint or rust on the surface of the joint. – Poor penetration ✓ Poor joint preparation ✓ Improper welding skills/techniques – Undercut ✓ Use of excessive current/heat ✓ Improper angle of electrode to base metal **2x4x½=**	**(4 marks)**

	c. Effect of defects on the joint – Lack of fusion Weakens the joint. – Porosity Creates a bad appearance on the finished joint. – Poor penetration Interferes with the properties of the welded material, making it less useful. – Undercut Gives a bad appearance of the finished joint. **Accept any other correct point4 x 1=**	**(4 marks)**
	d. Common cause of defects – Use of defective welding materials – Poor current setting or flame setting – Lack of skill/knowledge/techniques – Poor manipulation of the rods. **Any 1 x 1 =**	**(1 mark)**
14.	**Procedure** – File datum edges – Mark the ends – File the ends square – Mark the pattern – Cut the shape – File to the lines – Drill the hole – Draw file the workpiece – Finish	**Tools/ equipment used** – Hand file/bench vice. – Try square, scriber, rule – Hand file, trysquare. – Divider, centre punch, hammer, steel rule – Hacksaw, bench vice – Hand file, bench vice – Twist drill, drilling machine, m/c vice – Smooth file – Vice, Emery cloth. **9 steps @ 1 = 9 marks** **12 tools @ ½ = 6 marks**	**(15 marks)**

15.	a)  A – Minor diameter B – Major diameter C – Thread angle D – Root E – Crest F – Flank G – Pith H – Thread depth **Correct sketch – 2 marks** **Correct labels & naming 8 x ½ = 4 marks**	**(6 marks)**

(b) Types of taps



	Sketching 3×1=3 Naming 3×1=3 TOTAL = 6 **Sketching 3x1 = 3** **Naming 3x1 = 3**	**(6 marks)**
	c) Possible faults which may occur on a threaded hole – Skewed thread – Deeper threads on one side – Drunken thread- Tap not centrally aligned. – Incomplete thread – Threads not cut to full length of hole – Uncut thread – Pitch not properly achieved. **Accept any other correct answer** **2x1=**	**(2 marks)**
	d) – Lubrication - Cooling	**(1 mark)**