**PAST QUESTIONS AND ANSWERS**
**GENERAL METAL WORK (191-1)**
**MAY/JUNE 2008**

1(a) Outline any SIX protective wears in the workshop

1. Apron
2. Gloves
3. Goggles or shield
4. Helmet
5. Safety boots
6. Overall

(b) State TWO Safety precautions to be observed when cutting a piece of metal with an hacksaw and when filling a piece of metal with a file.

(i)

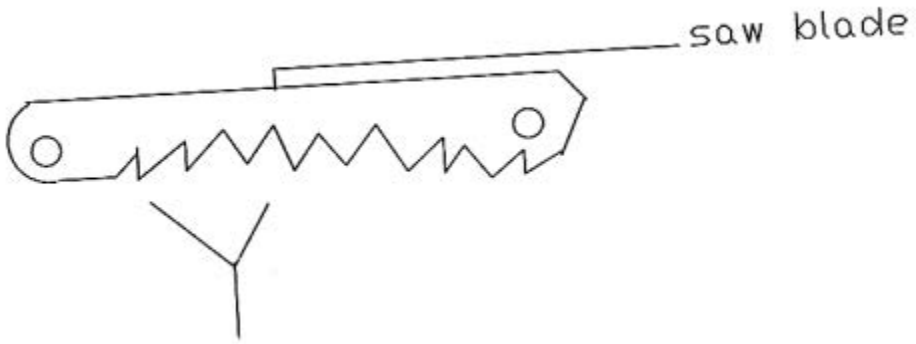
(1) The work piece must be squarely fixed to the bench vice.
(2) The saw bench must be fixed squarely and the teeth pointing forward with at least 3 teeth of the saw blade resting on the work piece.

(ii)

(1) The work piece must be squarely fixed to the vice
(2) The file should be sharp and must be having a good handle

(b) Describe the direction the teeth of a saw blade will be facing in relation to the handle when using a hacksaw on a workbench.

The saw blade teeth must be facing forward from the operator or worker.




Teeth of the Saw blade pointing forward

2(a) List the tools used to produce both internal and external thread on bench.
The tool used to produce both internal and external thread on the bench are:

- Tap and die respectively

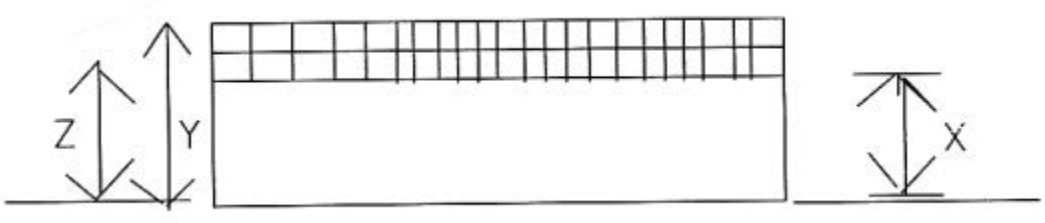
- Tap for internal thread
- Die for external thread

(b) State the THREE types of taps and explain how they are used to produce internal thread.

The three types of taps are:
1. Taper tap
2. Plug tap
3. Bottoming tap

To produce an internal thread, the taper tap is the first tap to be used because of its ease in entering the hole to commence the threading. Followed by the plug tap and finally the bottoming tap which give the thread the direct pitch, crest and root diameter. The plug and bottoming taps are generally used in a situation where the thread is not a through thread.

(c) Explain in addition to sketches the following:
(i) Lower limit
(ii) Upper limit
(iii) Tolerance
(iv) Unilateral and bilateral dimensions



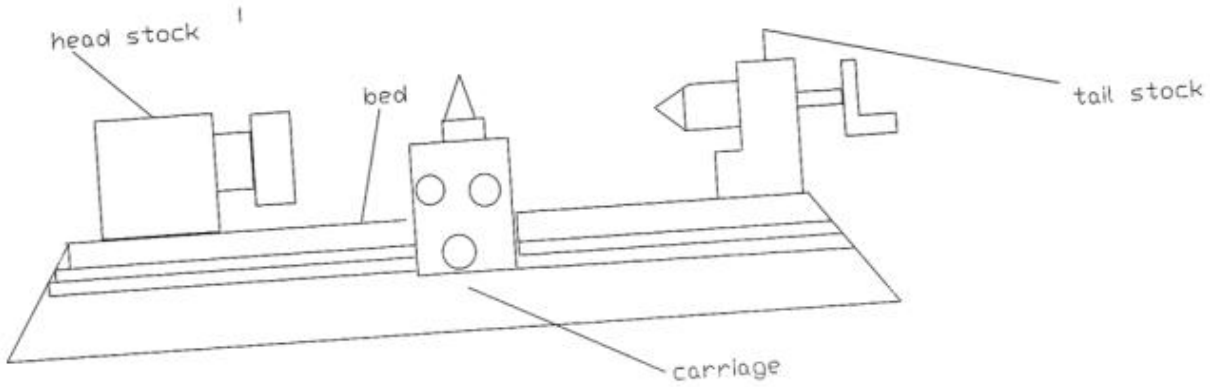

(i) Lower limit
The small amount of undersize allowed on a given dimension is called lower limit. This is indicated as 'X' in the above sketch.

(ii) Upper Limit
The oversize amount, allowed on a given dimension is called upper limit. This is indicated as 'Z' in the sketch

(iii) Tolerance
The difference between the oversize and undersize allowed on a given dimension is called Tolerance. In the sketch above Z – X is equal to tolerance, that is 'W'.

(iv) Unilateral and Bi-lateral Dimension
The limit provided on a given components is said to be unilateral, if it is provided on one side, that is ++ or --. The dimension is said to be Bi-lateral if it is provided on both sides, that is +-

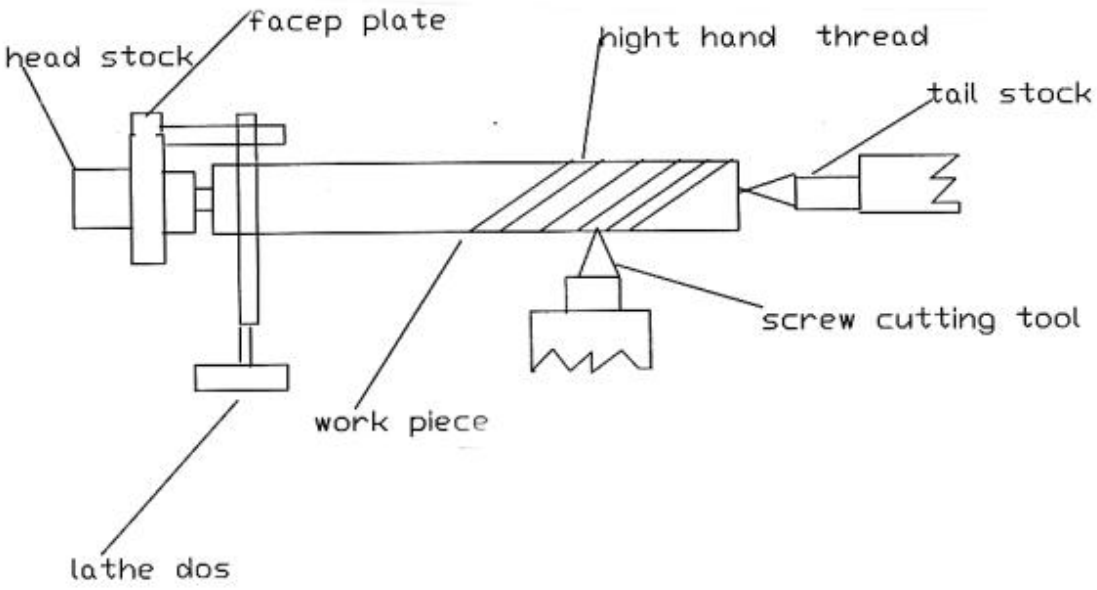
3(a) With a line sketch, show the following on a lathe machine:
(i) headstock
(ii) tailstock
(iii) carriage
(iv) bed




Line Sketch of Lathe Machine

(b) Explain screw cutting on the lathe, supporting your explanation with a sketh

Screw cutting on the Lathe
Screw cutting on the lathe machine is the process of cutting thread on the work piece. This is carried out by first mounting the work piece on the lathe chuck or between centres depending on the length of the work.
The workpiece is turn down to the major diameter of the thread. The threading tool is centered on the lathe tool post with the compound slide set to $29^{0.}$
The pitch of the thread is determined with the formular Driver/driven equal to the pitch of the lead screw.
The gear train is set on the lathe. The point of start is determined using the dial indicator. The tool is brought to touch the workpiece at the point of start .
The lathe is turned on with a slow speed and a light feed is taken by advancing the tool into the workpiece. This feed is moved along the length to be threaded. Having moved this length, the tool is withdrawn from the workpiece and moved to starting point again. Where new feed or cut is taken. This action is repeated until the required depth of cut is obtained.




4(a) Describe the following heat treatment processes:
(i) tempering
(ii) carburizing

(i) Tempering
Tempering is often called drawing or drawing the temper. It is heat treatment process which relieves internal strain in hardened steel and this increases it toughness. Steel can be tampered by heating it to a temperature below the lower critical temperature and then quenching. The tempering temperature depends upon the use to which the article is to be put. Tools are usually tempered at low temperatures. These temperature are judged by the temper colour which appear on the freshly polished surface of steel when it is heated.

(ii) Carburizing
This is the process of inducing carbon into steel. This is done by packing the steel components in boxes containing a carbon rich material e.g. carbon. The lids of the boxes are sealed with clay to exclude air. The boxes are heated at $900^0$c to $950^0$c for three to eight hours depending upon the depth of case required. After carburizing the components are allowed to cool slowly in the boxes.

(b) State TWO purposes of annealing a steel.
(i) To relieve internal stresses
(ii) To soften the material

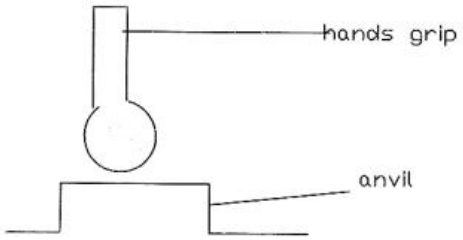
5(a) Differentiate between arc welding and gas welding with example.

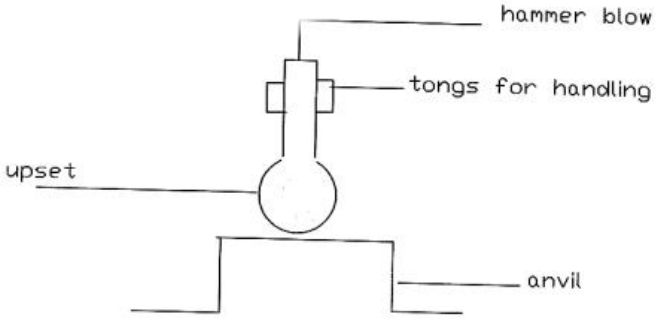
Gas Welding is also known as oxyacetylene welding. Oxyacetylene weld is a fusion weld. The heat produced by burning acetylene gas with oxygen gas makes the edges of metal to be welded melt and fused together while Arc welding is welding with an electric current. Two types of electrical current is used in Arc welding. These are the alternating current 'Ac' or the direct current Dc is used, it involves passing current through the electrode to the parent metal. With the electrode a little distance from the parent metal, causes an arc which melts the parent metal and the electrode thereby fusing together on solidification.

(b) Write briefly on the following forging processes:
- (i) Upsetting
- (ii) Drawing down
- (iii) Twisting
- (iv) Forming

(i) Upsetting

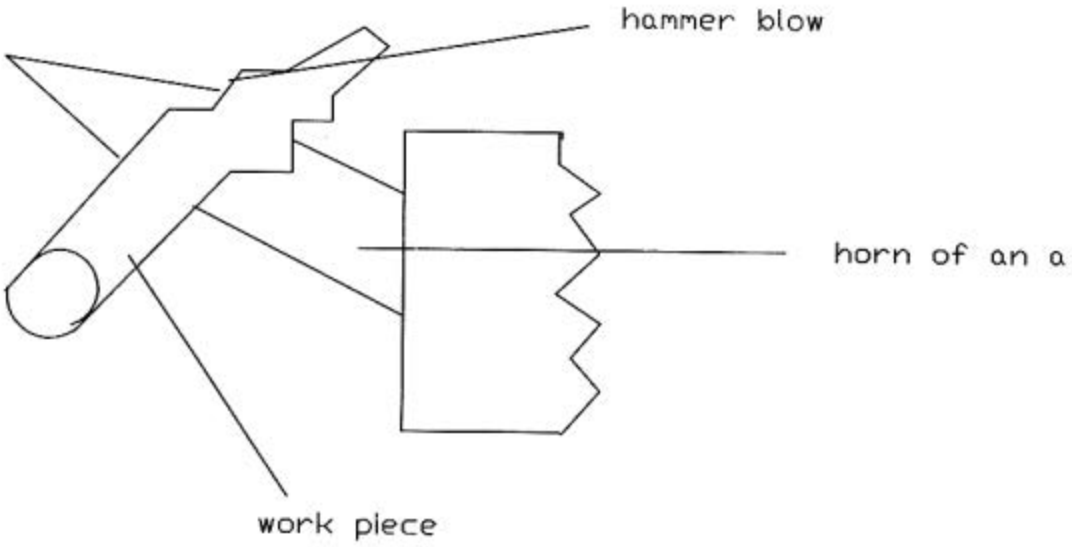
This is a foregoing operation in which the material being forged is thickened or bulged and at the same time shortened. A bar of iron may be upset by heating the end to a welding heat; then placing its hot end down on the top of the anvil and striking the other end with a hammer. If the bar is long, it may be grasped with both hands and the end bounced or rammed upon the anvil.



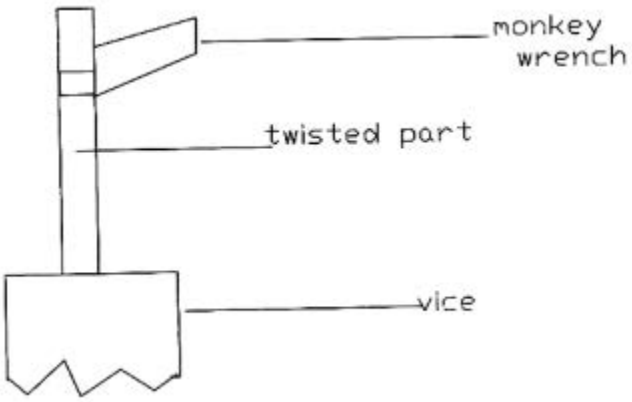




(ii) Drawing down

This is the same thing as drawing out. It is a forging operation in which stretching or lengthening of the material to be forged is done by hammering. The tapered part of a flat cold chisel is an example of drawing out metal. It involves the metal being heated until it is bright red otherwise it will tear. To draw or sketch the metal, it is placed quickly on the horn of an anvil and strike with hammer.




(iii) Twisting
This is a forging operation in which flat or square metal fixed in a vice may be turned with a monkey wrench to form the figure below.




(iv) Forming
This is a forging operation in which certain shape is copied e.g. the forming of a ring on the horn of an anvil.

6(a) Calculate the cutting speed of a drilling machine if the spindle speed is at 150rev/min and the diameter of the drill is 75mm.

Solution:

$$S = \frac{\pi DN}{1000}$$

S = Spindle speed m/mm
D = Diameter of workpiece mm

N = Number of Revolution per minutes
∏ = 22/7 = 3.142
N = 150 rev/min
D = 75mm

But S = ∏ DN/1000

$\therefore S = \frac{3.142 \times 75 \times 150}{1000}$

$= \frac{35\ 347.50}{1000}$

= 35.34m/min

(b) Describe how a taper shank twist drill can be removed from the spindle of a pillar drilling machine

Taper Shank twist drill can be removed from the spindle of a pillar drilling machine by the use of a drift and a hammer.

The drift is inserted into the slot by one side of the drilling machine spindle and with a light strike of the hammer on the head of the drift, pushes the drill bit out of the spindle. See sketch below.