

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

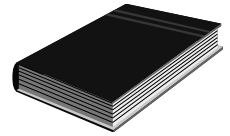
CODE: TS

IDENTIFY THREADS

INDEX

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SOURCE REFERENCES

Tables of thread pitches, diameters and angles.

Demonstration by a competent person.

OBJECTIVE

You will be learning towards the outcome “Identify threads”. Whilst learning towards the outcome you will be required to achieve the following:

- Identify the different types of threads used in Engineering.

On completion of this module, the learner must be able to:


- Use a vernier or a micrometer and a thread pitch gauge to measure the diameter and thread pitch of bolts, nuts and screws and identify them by comparing them with standard thread tables.
- Sort out and match bolts, screws and nuts.

During this process you must adhere to certain specified requirements as listed in the Module.

ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you may achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- A practical test will be set at the end of the module and must be completed without using references other than standard thread tables.
- The learner will be given an assortment of bolts and nuts, as well as a vernier and a thread pitch gauge and must, by measuring the diameter and pitch:
 - correctly identify all the different types of bolts and nuts.

<u>HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM</u>		
<div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> TS IDENTIFY THREADS </div> </div>		
STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Use measuring instruments to measure the dimensions of objects.	<ul style="list-style-type: none"> Improper or careless handling of measuring instruments can lead to damage to the instruments. 	<ul style="list-style-type: none"> Always handle measuring instruments, especially precision instruments, correctly and with great care. Wipe instruments clean after use and store in their appropriate packing cases in a safe place.

NOTE: Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner:

Signature of Training Officer:

Date:

1. TYPES OF THREADS

ITEM / TASK: Introduction.

DESCRIPTION:

In this module you will learn -

- how to distinguish between the three most commonly used basic thread forms, and,
- to identify the four “V” form threads most commonly used in the industry.

There are many other thread forms but they are only used in special circumstances.

ITEM / TASK: Thread forms.

DESCRIPTION:

Fig 1 below shows the three basic thread forms in use.

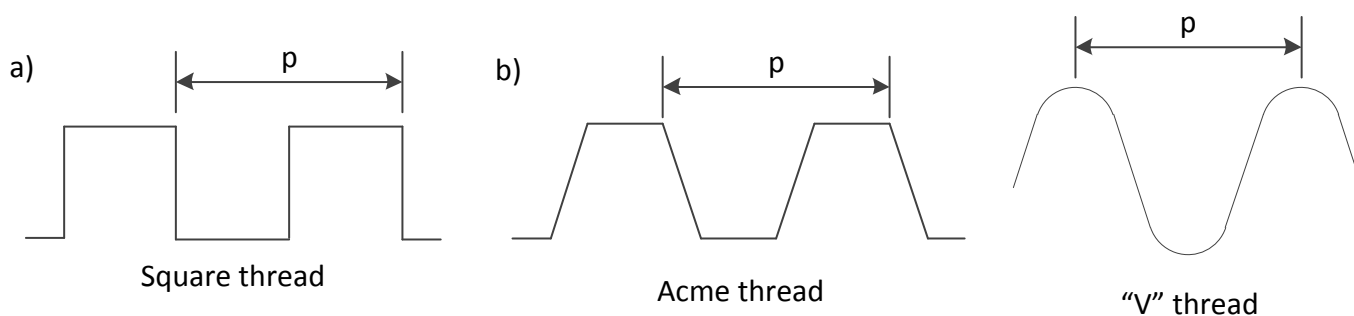


FIG 1.

a. Square Threads

Square threads are used on valve spindles, jack screws, vice screw spindles, etc.

b. Acme Threads

The lead screws of all lathes are machined with an Acme thread form. The Acme thread form is also used for the same purposes as the square thread.

c. “V” Form Threads

The “V” form thread is the most commonly used general purpose thread and will be discussed in greater detail below.

ITEM / TASK: The pitch of a thread.

DESCRIPTION:

- A. The **pitch** of a thread (P in Fig. 1 (a), (b) and (c)) is the distance measured from one point on the thread to a corresponding point on the next thread parallel to the axis of the thread.
- B. It is also the distance a nut will travel in one full revolution on a single-start thread.

ITEM / TASK: Classification of “V” form threads.

DESCRIPTION:

- A. The four most commonly used “V” thread forms are classified into two categories:
 - The metric system
 - The imperial system.
- B. The basic form for either system is shown in Fig 1(c).

2. THE METRIC THREAD SYSTEM

ITEM / TASK: Introduction.

DESCRIPTION:

A. The metric system adopted by the industry is the ISO (International Standards Organisation) system and consists of threads of the following types:

- Coarse thread series
- Fine thread series
- Constant pitch series.

B. The coarse and fine thread series are used mainly on bolts and screws, while the constant pitch series is used on tubing, i.e. electrical conduit tubing.

C. Thread size is expressed as follows:

M8 x 1.25

Where:	M	=	Metric
	8	=	Diameter of thread in mm
	1.25	=	Pitch of thread in mm

ITEM / TASK: Design details of the ISO metric thread.

DESCRIPTION:

Fig 2 below shows all the particulars of the ISO metric thread.

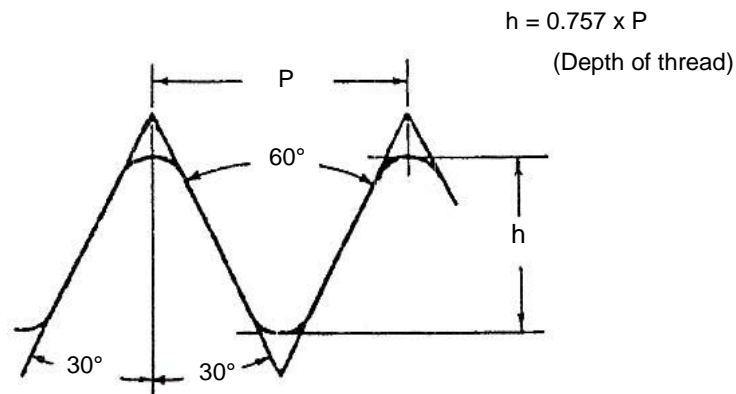


FIG 2.

ITEM / TASK: Measuring the diameter and pitch of a thread.

DESCRIPTION:

- Measure the diameter of the thread with an outside micrometer or vernier.
- Measure the pitch of the thread with a metric pitch gauge or metric rule. See Fig 3.
- Compare the measured diameter and the measured pitch with the thread tables (Tables 1 and 2 on the next page), to determine the standard size of the thread.

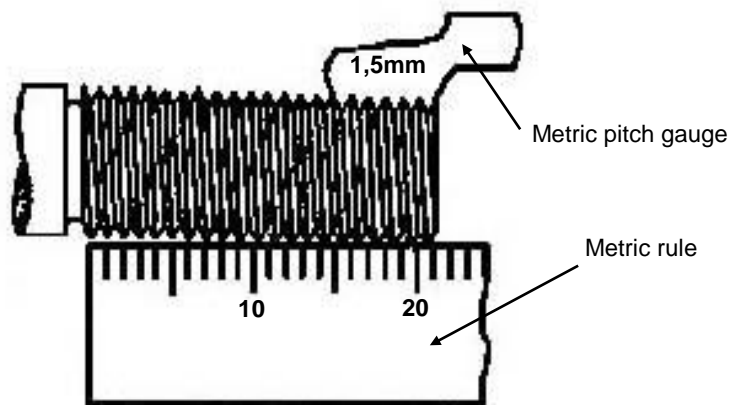


FIG 3.

Note:

- a. The diameters of metric threads will always be in full millimetres. The pitch can be in decimals, e.g. 0.25, 0.50, 0.75 etc. of a millimetre.
- b. Practice in working out the depth of a thread (Refer to Fig 2) will be given later in Module MTP for Fitter and Turner students.

TABLE 1

FINE PITCH METRIC SCREW THREADS	
FULL DIAMETER	PITCH
M 3	0.35
M 5	0.50
M 6	0.75
M 8	1.00
M 10	1.00
M 12	1.25
M 14	1.25
M 18	1.50
M 24	1.50

TABLE 2

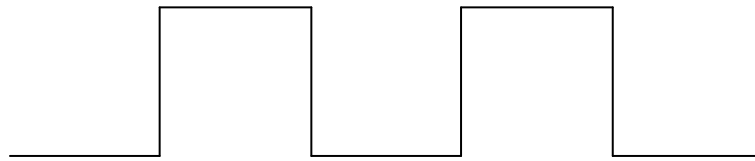
COARSE PITCH METRIC SCREW THREADS	
FULL DIAMETER	PITCH
M 3	0.50
M 5	0.80
M 6	1.00
M 8	1.25
M 10	1.50
M 12	1.75
M 14	2.00
M 18	2.50
M 24	3.00

**DO SELF TEST 1 AND THE PRACTICE ON THE FOLLOWING PAGES
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



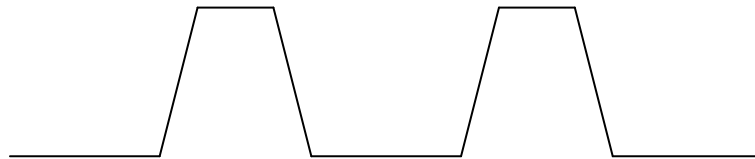
SELF TEST 1

1. Name the three thread forms shown below and give an example where each is used.



Name : _____

Use : _____



Name : _____

Use : _____



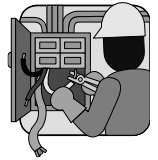
Name : _____

Use : _____

2. State what is meant by the term “pitch of a thread”.

Ask your Training Officer to check your work and if it is correct, to sign below before you do the practice on the next page.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



PRACTICE

Practice measuring and sorting out all the metric bolts and screws from the assortment of bolts provided.

- Write down all their sizes.
- All the metric bolts and screws must be sorted into "coarse" and "fine" thread series.

<u>Metric Course</u>	<u>Metric Fine</u>

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

3. THE IMPERIAL THREAD SYSTEM

ITEM / TASK: Introduction.

DESCRIPTION:

The two main imperial “**V**” **form** thread systems used in the industry are:

- Unified thread system, and
- Whitworth thread system.

ITEM / TASK: The Unified thread system.

DESCRIPTION:

A. The Unified thread system is also an ISO standard and is available in three series namely:

- Unified Coarse Thread Series (UNC)
- Unified Fine Thread Series (UNF)
- Unified Special Thread Series (UNS).

Of the three series, UNC and UNF are the most commonly used. See Tables 3 and 4.

B. The thread form and angle, and the formula for working out the depth of the thread are identical to that of the ISO metric system. Refer back to Fig 2.

The only difference is that, being an imperial system, the diameter of the thread is expressed in **inches** and the pitch of the thread as **threads per inch** or **TPI**.

The term TPI means the number of threads that can be counted over a distance of one inch (1") or 25.4mm, when measured with a steel rule. (Fig 4)

N.B.

This applies to all imperial threads.

C. It will be noted in Fig 4 that 18 threads can be counted over a distance of one inch. (25.4mm)

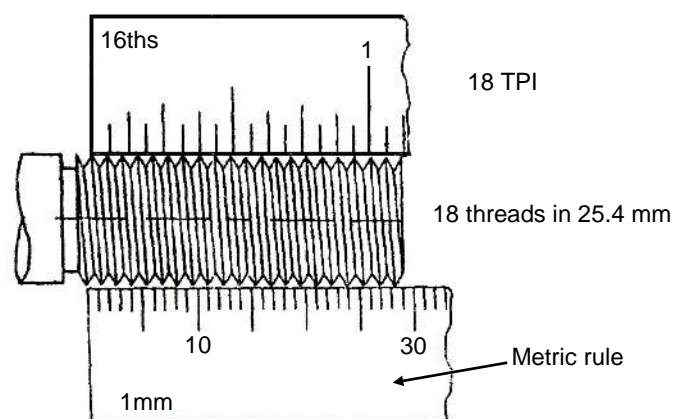


FIG 4.

TABLE 3

UNIFIED FINE SCREW THREADS (UNF)					
FULL DIAMETER			TPI	PITCH	
INCHES		MM		INCHES	MM
$\frac{1}{4}$	0.250	6.350	28	0.035	0.890
$\frac{5}{16}$	0.312	7.937	24	0.041	1.041
$\frac{3}{8}$	0.375	9.525	24	0.041	1.041
$\frac{1}{2}$	0.500	12.700	20	0.050	1.270
$\frac{5}{8}$	0.625	15.875	18	0.055	1.397
$\frac{3}{4}$	0.750	19.050	16	0.062	1.575
$\frac{7}{8}$	0.875	22.225	14	0.071	1.803
1	1.000	25.400	12	0.083	2.108

TABLE 4

UNIFIED COURSE SCREW THREADS (UNC)					
FULL DIAMETER			TPI	PITCH	
INCHES		MM		INCHES	MM
$\frac{1}{4}$	0.250	6.350	20	0.050	1.270
$\frac{5}{16}$	0.312	7.937	18	0.055	1.397
$\frac{3}{8}$	0.375	9.524	16	0.062	1.575
$\frac{1}{2}$	0.500	12.699	13	0.078	1.981
$\frac{5}{8}$	0.625	15.874	11	0.091	2.311
$\frac{3}{4}$	0.750	19.049	10	0.100	2.540
$\frac{7}{8}$	0.875	22.224	9	0.111	2.819
1	1.000	25.400	8	0.125	3.175

ITEM / TASK: The Whitworth Thread System.

DESCRIPTION:

A. The Whitworth Thread System is a British thread system and is available in three series namely:

- British Standard Whitworth (BSW) coarse series
- British Standard Fine (BSF) fine series
- British Standard Pipe (BSP) constant pitch series.

B. The coarse and fine series, BSW and BSF, of the Whitworth Thread System are used mainly on bolts, while the constant pitch series, BSP, is used mainly on pipes.

Tables 5, 6, and 7 on the following pages are the thread tables for the Whitworth Thread System.

C. Fig 5 below contains the design details of the Whitworth Thread System.

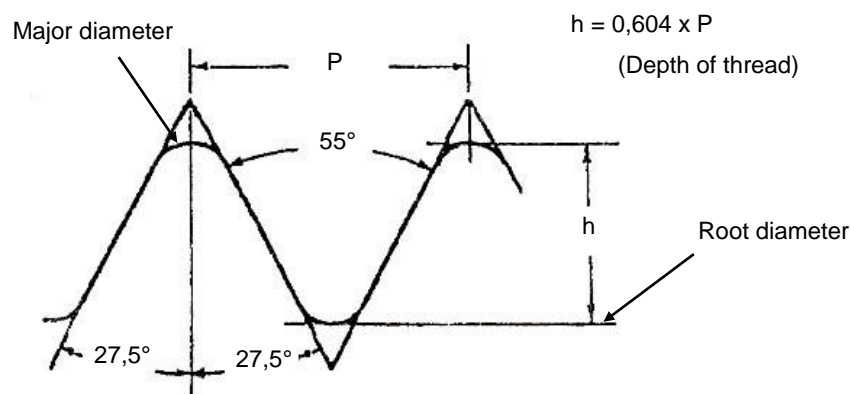


FIG 5.

ITEM / TASK: Measuring diameter and pitch of BSW and BSF threads.

DESCRIPTION:

- A. Measure the outside diameter of the thread with an imperial (inch) micrometer (or with a metric micrometer, and convert the size to inches).
- B. Measure the pitch (TPI) with a Whitworth thread pitch gauge or a rule. (Fig 6)
- C. Compare the measured diameter and the measured TPI with the thread tables (Tables 6 and 7) to determine the type and size of the thread.

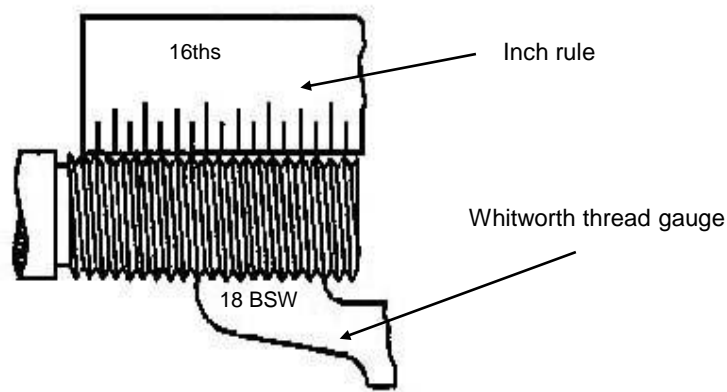


FIG 6.

NB:

Note that the 18 TPI blade of the Whitworth thread pitch gauge fits the thread and also that 18 threads can be counted over one inch on the rule.

ITEM / TASK Measure a pipe thread.

DESCRIPTION:

A. BSP is the standard pipe thread adopted throughout the world. It is available in two forms, i.e. parallel and taper. See Fig 7 for the taper version.

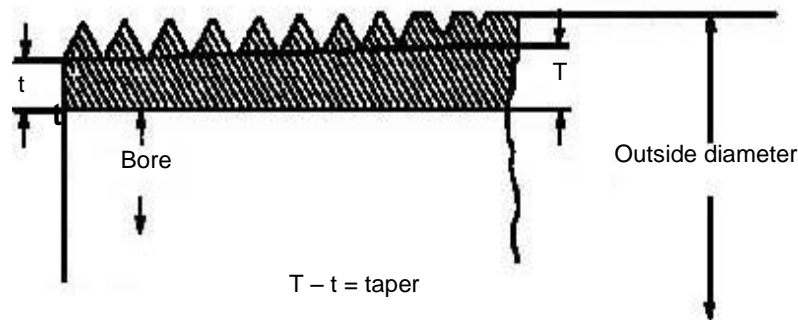


FIG 7.

N.B.

The taper of the thread can be seen by comparing the line drawn along the root of the thread with the line drawn parallel to the bore of the pipe.

B. Measure the pipe thread as follows:

- Measure the bore of the threaded pipe. **This represents the nominal size of the thread.**
- Measure the TPI of the thread with a Whitworth pitch gauge.
- Compare the size and the TPI with the pipe thread table. (Table 7)

There are four pitches in the BSP constant pitch series. They are:

- 28 TPI
- 19 TPI
- 14 TPI and,
- 11 TPI as shown in Table 7.

All standard threaded pipes with bore sizes larger than 50 mm are also 11 TPI.

TABLE 5

BRITISH STANDARD FINE SCREW THREADS (BSF)					
FULL DIAMETER			TPI	PITCH	
INCHES		MM		INCHES	MM
$\frac{1}{4}$	0.250	6.350	26	0.038	0.965
$\frac{5}{16}$	0.312	7.937	22	0.045	1.143
$\frac{3}{8}$	0.375	9.525	20	0.050	1.270
$\frac{1}{2}$	0.500	12.700	16	0.062	1.575
$\frac{5}{8}$	0.625	15.875	14	0.071	1.803
$\frac{3}{4}$	0.750	19.050	12	0.083	2.108
$\frac{7}{8}$	0.875	22.225	11	0.091	2.311
1	1.000	25.400	10	0.100	2.540

TABLE 6

BRITISH STANDARD WHITWORTH SCREW THREADS (BSW)					
FULL DIAMETER			TPI	PITCH	
INCHES		MM		INCHES	MM
$\frac{1}{4}$	0.250	6.350	20	0.050	1.270
$\frac{5}{16}$	0.312	7.937	18	0.055	1.397
$\frac{3}{8}$	0.375	9.524	16	0.062	1.575
$\frac{1}{2}$	0.500	12.699	12	0.078	2.108
$\frac{5}{8}$	0.625	15.874	11	0.091	2.311
$\frac{3}{4}$	0.750	19.049	10	0.100	2.540
$\frac{7}{8}$	0.875	22.224	9	0.111	2.819
1	1.000	25.400	8	0.125	3.175

TABLE 7

BRITISH STANDARD PIPE SCREW THREADS		
NOMINAL BORE		TPI
MM	INCHES	
3	$\frac{1}{8}$	28
6	$\frac{1}{4}$	19
9.5	$\frac{3}{8}$	19
13	$\frac{1}{2}$	14
19	$\frac{3}{4}$	14
25	1	11
32	$1\frac{1}{4}$	11
38	$1\frac{1}{2}$	11
50	2	11
NB: The nominal bore is also the nominal thread size		

**DO SELF TEST 2 AND THE PRACTICE ON THE FOLLOWING PAGES
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



SELF TEST 2

1. Explain what is meant by the term TPI.

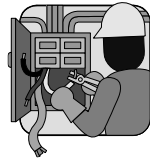
2. Name two imperial thread systems and state the inclusive thread angle for each one.

a. _____ Angle _____

b. _____ Angle _____

Ask your Training Officer to check your work and if it is correct, to sign below before you do the practice on the next page.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



PRACTICE

Practice measuring and sorting out all the imperial bolts and screws from an assortment of bolts provided.

- Classify them into the “coarse” and “fine” series for each of the two imperial thread systems described.
- Write down their sizes.

Also practice measuring threaded pipes, and write down the nominal thread sizes.

<u>Imperial Course</u>	<u>Imperial Fine</u>

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

4. THE BRITISH ASSOCIATION (BA) THREAD SYSTEM

ITEM / TASK: Introduction.

DESCRIPTION:

Note:

The British Association or BA thread system is no longer commonly used in this country. The information below is given for information purposes only, and will not be examined.

The BA thread system is neither metric nor imperial. It is a system designed to provide screws of a size not catered for by the ISO metric, ISO Unified and Whitworth thread systems.

ITEM / TASK: Design of BA threads.

DESCRIPTION:

Fig 8 shows the design characteristics of a BA thread.

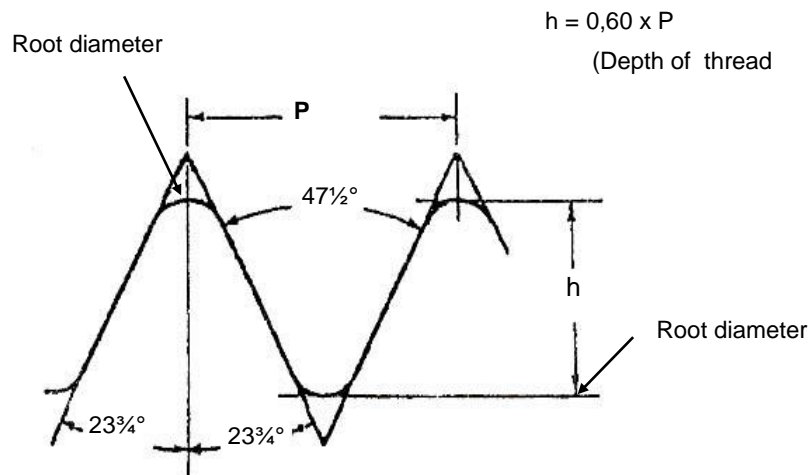


FIG 8.

ITEM / TASK: Measuring the diameter and pitch of a BA thread.

DESCRIPTION:

- A. Measure the outside diameter of the thread with an imperial (inch) micrometer (or a metric micrometer and convert to inches).
- B. Compare the size with the BA thread table. (Table 8 below)
- C. Note the number of the BA screw size in line with the diameter.

TABLE 8

BRITISH ASSOCIATION SCREW THREADS (BA)					
FULL DIAMETER			TPI	PITCH	
NO.	MM	INCHES		MM	INCHES
0	6.0	0.236	25.4	1.00	0.0394
1	5.3	0.209	28.2	0.90	0.0354
2	4.7	0.185	31.4	0.81	0.0319
3	4.1	0.161	34.8	0.73	0.0287
4	3.6	0.142	38.5	0.66	0.0260
5	3.2	0.126	43.1	0.59	0.0232
6	2.8	0.110	47.9	0.53	0.0209
7	2.5	0.098	52.9	0.48	0.0189
8	2.2	0.087	59.1	0.43	0.0169
9	1.9	0.075	65.1	0.39	0.0154
10	1.7	0.067	72.6	0.35	0.0138
11	1.5	0.059	81.9	0.31	0.0122
12	1.3	0.051	90.7	0.28	0.0110
13	1.2	0.047	102	0.25	0.0098
14	1.0	0.039	110	0.23	0.0091



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire self tests and practices, you are now at liberty to request a **Formative Assessment** from your Assessor.