Pearson BTEC Levels 4 and 5 Higher Nationals in Engineering (RQF)

Unit 3: Engineering Science (core)

Unit Workbook 1

in a series of 4 for this unit

Learning Outcome 1

Scientific Data

1.1 International system of units

The basic dimensions in the physical world and the corresponding SI base units

The International System of Units (abbreviated to SI from the French '**S**ysteme **I**nternationale d'unites') is widely used in the western world, particularly in the European Union and United Kingdom. This system of units was originally devised to describe quantities such as mass, time and length. These three quantities can actually describe any other quantity (see our Maths workbooks describing Dimensional Analysis for more details) and were known as Base units. Over time the Base units have been added to, resulting in seven base units currently adopted, as per the table below.

Name of Unit	Symbol Used	Name of Quantity
metre	m	length
kilogram	kg	mass
second	s	time
Ampere	A	electric current
Kelvin	K	temperature
mole	mol	amount of substance
candela	cd	luminous intensity

Table 1.1 *The SI Base Units*

SI derived units with special names and symbols

Combining one or more of the symbols in table 1.1 can result in the definition of **derived** units. For example, the reciprocal of time is frequency (Hz). Also, the product of electric current and time gives electric charge (C). There can be an infinite number of derived units but a selection of the more common ones are given names, as per frequency and charge, just described. Table 1.2 contains the more common derived units found in engineering.

Name of Unit	Symbol Used	Name of Quantity
Coulomb	C	electric charge
Degrees Celsius	^{o}C	temperature (^{o}K – 273.15 ^{o}K)
Farad	F	capacitance
Henry	H	inductance
Hertz	Hz	frequency
Joule	J	energy/work/heat
lumen	lm	luminous flux
lux	lx	illuminance
Newton	N	force or weight
Ohm	Ω	resistance/impedance/reactance

1.2 Interpreting data

Investigation using the scientific method to gather appropriate data

The Scientific Method, as it's known, is a way of to find out 'cause and effect' relationships. It is undertaken by asking questions, gathering data, analysing data, and interpreting the results of data analysis. There are six common steps within the Scientific Method;

1. Ask a question about something – how, what, when, who, which, why, where? etc.
2. Perform research – know your subject material
3. Propose a hypothesis – make an educated guess based upon your research and ensure it can be tested
4. Test the hypothesis – perform an experiment(s)
5. Analyse the data - to indicate whether the hypothesis is supported by data (or not)
6. Present your results – perhaps a written report, scientific paper or presentation

Summarising quantitative and qualitative data with appropriate graphical representations.

Worked Example 1

Two hundred WiFi installations were tested to ascertain their data download rate in millions of bits per second (Mbps). The results, rounded to the nearest integer, were as follows;

Download rate in Mbps	Number of WiFi installations
0 to 25	20
26 to 50	80
51 to 75	60
76 to 100	40

Represent these results graphically using;

i. A Histogram

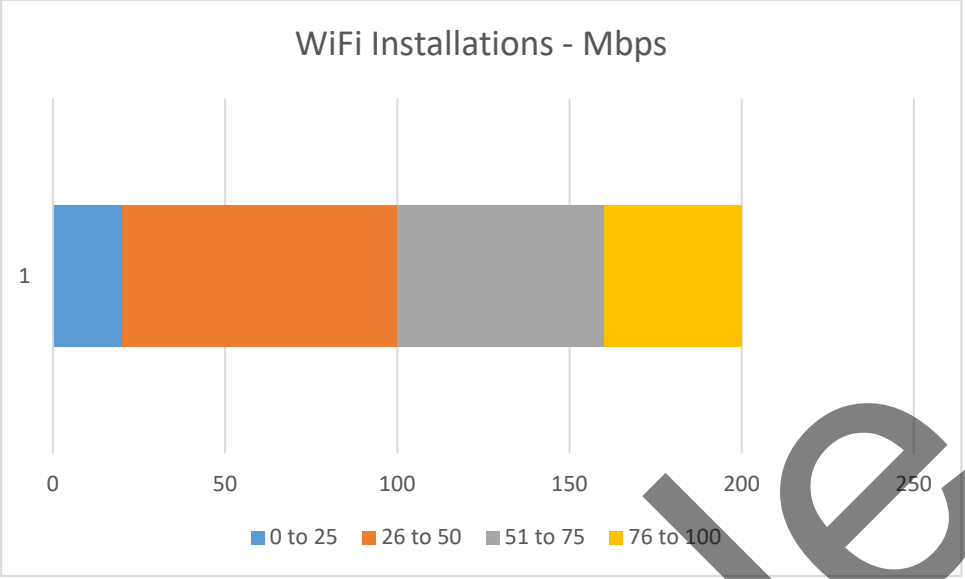
ii. A Stacked Bar Chart

ANSWER

i Histogram

The following chart was generated from Microsoft Excel, but can also be generated using OpenOffice Calc (which is free).

ii Stacked Bar Chart



Worked Example 2

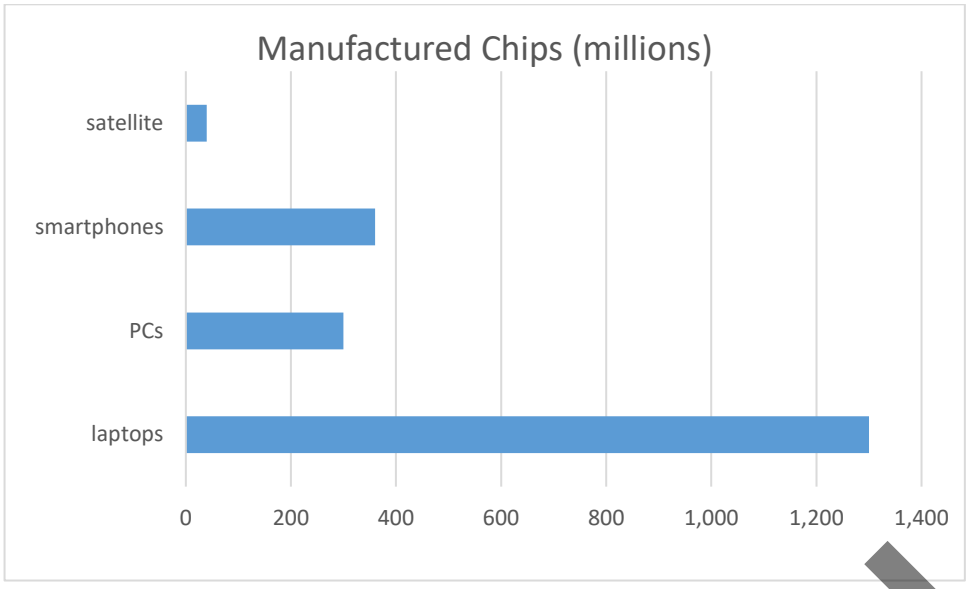
A semiconductor manufacturer produces two billion silicon chips per year. Of these, 1,300 million are integrated into laptop computers, 300 million into desktop PCs, 360 million into smartphones and 40 million into satellite receivers. For this qualitative data, produce;

i. A Bar Chart

ii. A Pie Chart

ANSWER

i Bar Chart



ii Pie Chart