4) Which type of graph begins at a base line, either horizontally or vertically, and shows the relationship between two or more related variables?
   a) Linear graph
   b) Bar graph
   c) Vector graph

5) Match the word/phrase that correctly completes each sentence/ statement:

a) _____ charts/graphs are visual representations of numerical values:	Pie
b) _____charts are also referred to as sector charts:	Bar
c) _____charts are used to represent small numbers of plotted values and to make a simple comparison of two values along two axes:	Bar
d) _____ are used to compare large numbers of values in a compact space, to calculate values that fall between the plotted points, and to compare trends:	X-Y graphs

5. Units of measurement and conversion factors

Overview

Purpose

A gas technician/fitter needs to know both the traditional Units of measurement and the SI (metric) Units of measurement in technical manuals, specifications, drawings, and graphs. Installing and servicing the gas equipment in accordance with specifications requires prior understanding of the Units of measurement.

Objectives

At the end of this Chapter, you will be able to:

- identify Units of measurement for various components the gas technician/fitter will encounter; and
- convert from one Unit of measurement to another.

Terminology

Term	Abbreviation (symbol)	Definition
Imperial Units		System of measurement derived from earlier English system of measurement Units
International System of Units	SI	A rationalized, coherent, simplified system of measurement based on the metric system

Units of measurement

Countries that participate in the activities of the General Conference of Weights and Measures (CGPM), the International Organization for Standardization (ISO), and the International Electrotechnical Commission (IEC) have developed and approved the International System of Units (SI), a rationalized, coherent, simplified metric-based system of measurement. Canada is a member of all these organizations.

However, many Units of measurement that the gas industry uses are still in imperial Units of measurement.

The use of prefixes indicates the order of magnitude of the quantity noted. Thus, the prefix 'k' used with the symbol 'W' for watts, indicates 1000 watts or a kilowatt. The prefix 'M' used with the symbol J for joule indicates 1,000,000 joules or a megajoule (MJ).

Table 5-1 lists the prefixes that a gas technician/fitter typically encounters.

Table 5-1
Prefixes

Symbol	Name	Multiplying factor
G	giga	1 000 000 000 = 10^9
*M	mega	1 000 000 = 10^6
k	kilo	1,000 = 10^3
d	deci	0.1 = 10^{-1}
c	centi	0.01 = 10^{-2}
m	milli	0.001 = 10^{-3}
μ	micro	0.000 001 = 10^{-6}
n	nano	0.000 000 001 = 10^{-9}
p	pico	0.000 000 000 001 = 10^{-12}

***Note**: Sometimes in imperial measurement, "M" represents a multiplying factor of 1,000 = 10^3 (e.g., MBtu/h = 1,000s of Btu/h).

Table 5-2 provides both the imperial and SI Units that the industry uses to measure various gas technology items.

Table 5-2
Imperial and SI Units for measuring various gas technology items

	Units of measurement	
To measure	**Imperial**	**SI (metric)**
Length	Inches (in) Feet (ft) Miles (mi)	Centimetres (cm) Metres (m) Kilometres (km)
Area	Square inches (in^2) Square feet (ft^2)	Square centimetres (cm^2) Square metres (m^2)
Volume of liquid	Gallon (gal)	Litre (l)
Volume of gas	Cubic feet (ft^3)	Cubic metres (m^3)
Flow rate of gas	Cubic feet per hour (ft^3/h)	Cubic metres per hour (m^3/h)
Colorific value of a fuel gas	British thermal Units per cubic foot (Btu/ft^3)	Megajoules per cubic metre (MJ/m^3)
Pressure	Pounds per square inch (psig) Inches water column (inches w. c.)	Kilopascal (kpa) Kilopascal (kpa)
Mass	Ounces (oz) Pounds (lb)	Grams (g) Kilograms (kg)
Temperature	Degrees Fahrenheit (°F)	Degrees Celsius (°C)
Heat (energy)	British thermal Units (Btu)	Joules (J)
Heat rate (power)	Horsepower (HP) British thermal Units per hour (Btu/h) (sometimes written Btuh)	Watts (W) Kilowatts (kw)

Conversion factors

Conversion factors are what you use to calculate the value of a measurement as a different Unit of measurement. For example, you use a conversion factor of 25.4 to convert an inch measurement to a millimetre measurement (e.g., 2 inches = 2 x 25.4 or 50.8 mm).

Table 5-3 lists a number of conversion factors that a gas technician/fitter typically uses.

Table 5-3
Conversion factors

Multiply	By	To obtain
Btu/ft^3	0.03723	MJ/m^3
Btu/h	0.00029295	kW
°F	(°F-32) × 5/9	°C
ft	0.3048	m
ft^3	28.31685	dm^3
ft^3	0.028317	m^3
ft^3/h	0.028328	m^3/h
gal	4.546	L
U.S. gal	3.785	L
HP	745.699	W
in	25.4	Mm
in^2	645.16	mm^2
in w.c.	249	P
in w.c.	0.249	kPa
lb	453.6	G
MJ/h	0.2778	kW
oz	28.35	g
psig	6.894757	kPa

Assignment Questions – Chapter 5

1) Complete the following by selecting the correct conversion: 400 000 Btu/h = _____ kW
   a) 171
   b) 711
   c) 717
   d) 117

2) Complete the following by selecting the correct conversion: 50 ft^3 = _____ m^3
   a) 1.24
   b) 1.42
   c) 14.2
   d) 12.4