

Wollo University
Kombolcha Institute of Technology
Department of mechanical Engineering
Total Quality Management Worksheet 1

- 1) Metal thickness in silicon wafers (very thin slice of semiconductor crystal used as substrate for solid –state circuitry). Table 1 presents thickness of metal layer on 100 silicon wafers resulting from chemical vapor deposition (CVD) process in semiconductor plant.

Layer Thickness (Å) on Semiconductor Wafers

438	450	487	451	452	441	444	461	432	471
413	450	430	437	465	444	471	453	431	458
444	450	446	444	466	458	471	452	455	445
468	459	450	453	473	454	458	438	447	463
445	466	456	434	471	437	459	445	454	423
472	470	433	454	464	443	449	435	435	451
474	457	455	448	478	465	462	454	425	440
454	441	459	435	446	435	460	428	449	442
455	450	423	432	459	444	445	454	449	441
449	445	455	441	464	457	437	434	452	439

Based on this data

- a) Construct the histogram and show the distribution of data
- b) Interpreting the graph

- 2) Based on the following data construct the histogram and summarize the data graphically

-180	30	190	380	330	140	160	270	10	- 90
- 10	30	60	230	90	120	10	50	250	180
-130	220	170	130	- 50	- 80	180	100	110	200
260	190	-100	150	210	140	-130	130	150	370
160	180	240	260	- 20	- 80	30	80	240	130
210	40	70	- 70	250	360	120	- 60	- 30	200
50	20	30	280	410	70	- 10	20	130	170
140	220	- 40	290	90	100	- 30	340	20	80
210	130	350	250	- 20	230	180	130	- 30	210
-30	80	270	320	30	240	120	100	20	70
300	260	20	40	- 20	250	310	40	200	190
110	-30	50	240	180	50	130	200	280	60
260	70	100	140	80	190	100	270	140	80
110	130	120	30	70					

TOTAL = 135

- 3) The followings are the data collected for number of visual defective (glass bottles) over the past three months (January to March, 2016)

S.No.	Type of defects	Number of defective		
		January	Februar	March
1	Ring crack	106	10	17
2	Body crack	68	7	21
3	Neck crack	86	10	59
4	Heavy seam	35	79	150
5	Folding	29	101	46
6	Blisters	171	174	181
7	Bird swing	-	111	2
8	Dirty mould	5	42	27
9	Double seam	-	293	41
10	Stone	178	56	22
11	Baffle mark	25	71	56
12	Shear mark	-	-	16
13	Chocked neck	34	-	10
14	Bottom crack	10	-	4
15	Wash board	83	-	23
16	Seeds	22	-	29

Based on the above data:

- a) Construct the Pareto diagram of the given defect data over the past three months
- b) Identify the prioritize major problem for further investigation among the defects.
- c) Construct the p-chart and identify whether the process is in control or not.

4. Patients at the Rouse Home have been complaining recently about the conditions at the home. The administrator would like to use a Pareto chart to investigate. When a patient or patient's relative has a complaint, they are asked to complete a complaint form. Listed below is a summary of the complaint forms received during the last 12 months.

Complaint	Number	Complaint	Number
Nothing to do	45	Dirty conditions	63
Poor care by staff	71	Poor quality food	84
Medication error	2	Lack of respect by staff	35

Develop a Pareto chart. What complaints would you suggest the administrator work on first to achieve the most significant improvement?

5.

Out of 110 diesel engines tested, a rework and repair facility found 9 had leaky water pumps, 15 had faulty cylinders, 4 had ignition problems, 52 had oil leaks, and 30 had cracked blocks. Draw a Pareto chart to identify the key problem in the production process.

6. Construct the variable control chart of \bar{X} -bar and R using the following data

Sample	Slip Ring Diameter (cm)				
	1	2	3	4	5
1	5.02	5.01	4.94	4.99	4.96
2	5.01	5.03	5.07	4.95	4.96
3	4.99	5.00	4.93	4.92	4.99
4	5.03	4.91	5.01	4.98	4.89
5	4.95	4.92	5.03	5.05	5.01
6	4.97	5.06	5.06	4.96	5.03
7	5.05	5.01	5.10	4.96	4.99
8	5.09	5.10	5.00	4.99	5.08
9	5.14	5.10	4.99	5.08	5.09
10	5.01	4.98	5.08	5.07	4.99

- a) *Identify whether the control chart is in control or not*
- b) *Identify the cause of variation and Interpret the charts*

7. A production manager at a tire manufacturing plant has inspected the number of defective tires in twenty random samples with twenty observations each. Following are the number of defective tires found in each sample:

Sample Number	Number of Defective Tires	Number of Observations Sampled
1	3	20
2	2	20
3	1	20
4	2	20
5	1	20
6	3	20
7	3	20
8	2	20
9	1	20
10	2	20
11	3	20
12	2	20
13	2	20
14	1	20
15	1	20
16	2	20
17	4	20
18	3	20
19	1	20
20	1	20
Total	40	400

- a) *Construct a three-sigma control chart ($z=3$) with this information.*
- b) *Interpret the chart*

8. The number of weekly customer complaints are monitored at a large hotel using a c-chart. Complaints have been recorded over the past twenty weeks. Develop three-sigma control limits using the following data:

																				Total	
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
No. of Complaints	3	2	3	1	3	3	2	1	3	1	3	4	2	1	1	1	3	2	2	3	44