POLITEKNIK MALAYSIA
KUALA TERENGGANU

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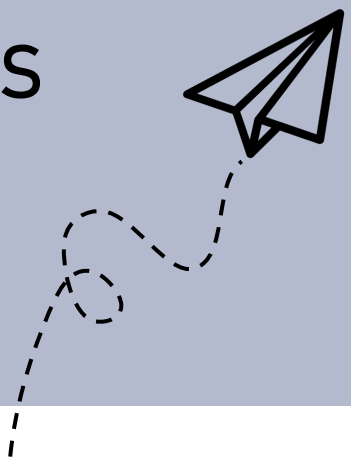
KOLEJ KOMUNITI MALAYSIA

PHYSICAL QUANTITIES AND MEASUREMENTS

Penulis :
NOR FADZLINA BINTI AINUDDIN

TEKNOLOGI & PERKOMPUTERAN

PHYSICAL QUANTITIES AND MEASUREMENTS



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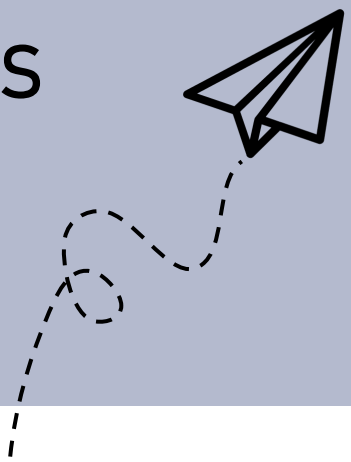

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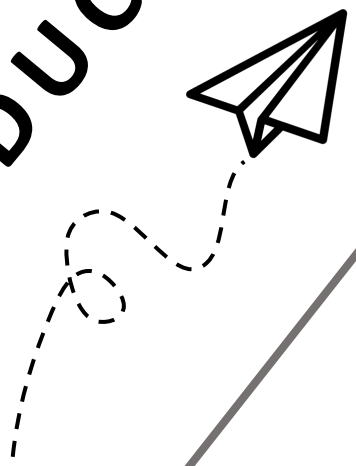
INTRODUCTION



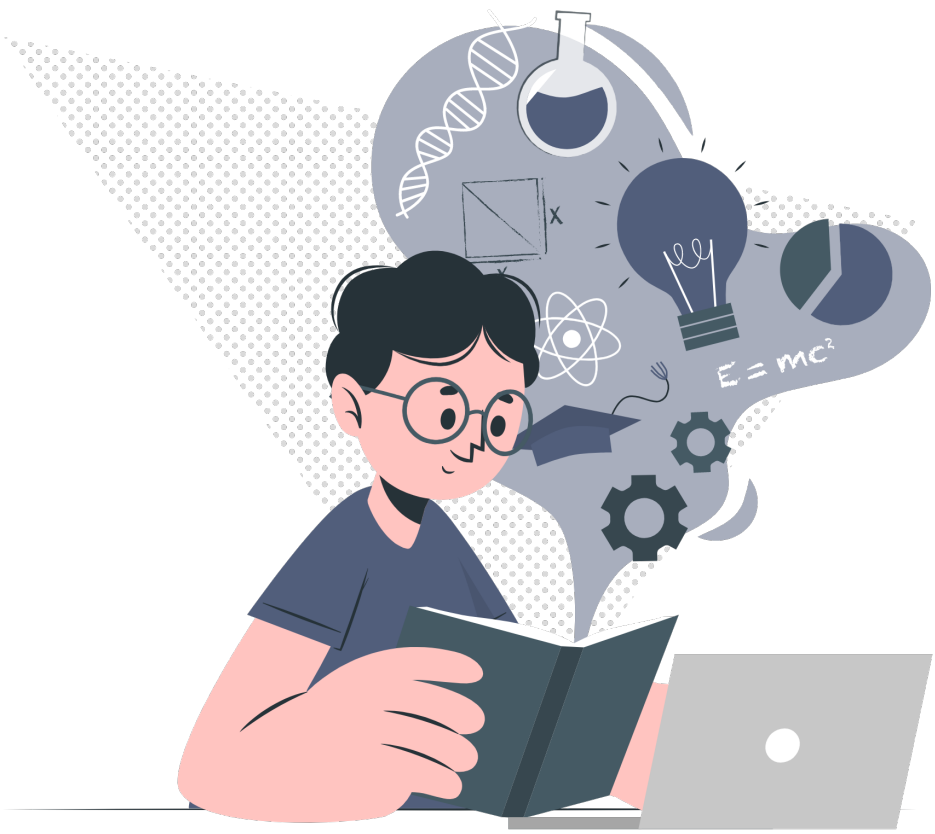
PHYSICAL QUANTITIES AND MEASUREMENTS

introduces the physical concepts required in engineering disciplines. Students will learn the knowledge of fundamental physics in order **to identify and solve engineering physics problems** to mastery physics concepts.

ACKNOWLEDGMENT

I’m eternally grateful would like to thank for everyone who involved in the production of this book. Special thanks to my family and colleagues for their support and encouragement throughout the preparation for this book.

Finally, I would like to express my gratitude to the publisher and for all involved in the production of the book. I hope this book would serve its purpose in helping students gain better understanding of the Physical Quantities and Measurements.



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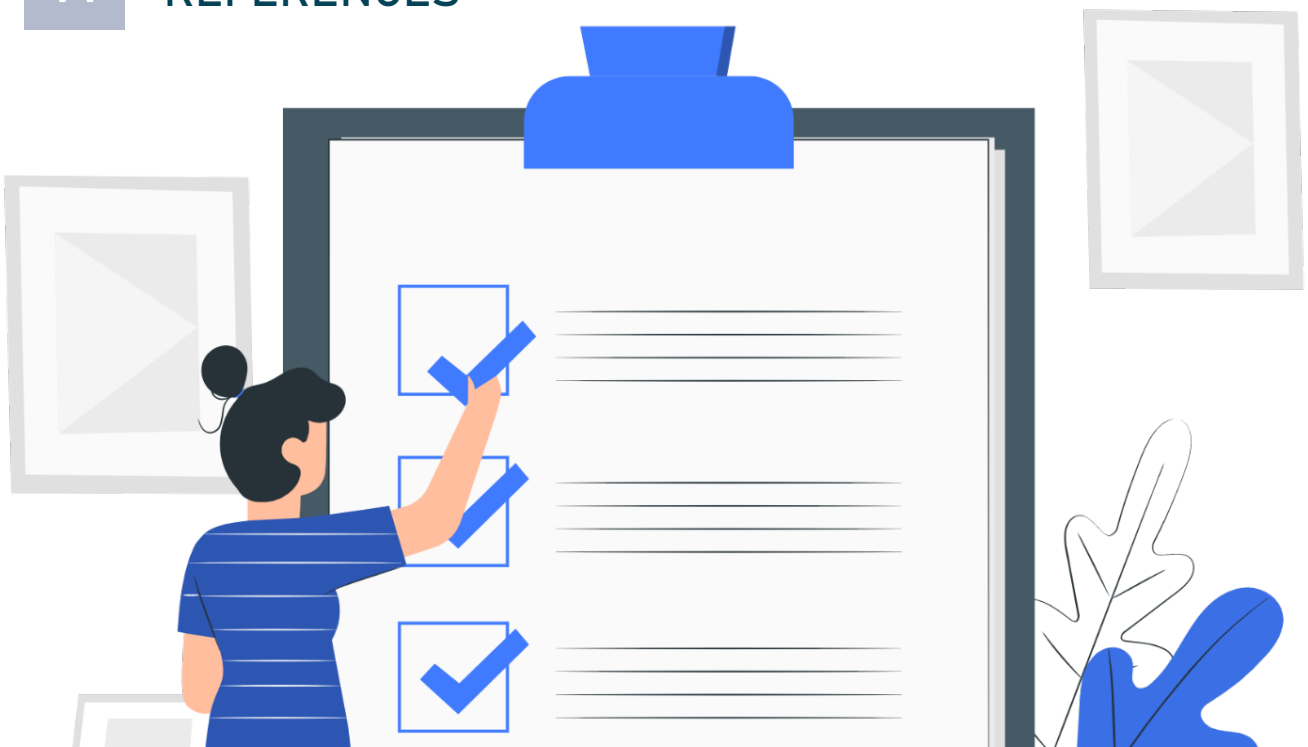


THE PHYSICAL QUANTITIES

01

Base quantities, derived quantities and the International System (SI) of units

THE PHYSICAL QUANTITIES defined as quantity that can be measured by measurement.
Physical Quantities can be divided into two (2) types:

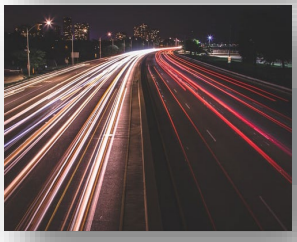
BASE QUANTITIES

Define: physical quantity that cannot be expressed in terms of other physical quantities.

EXAMPLE	QUANTITIES, *SI UNIT*
	**Length,** ***meter (m)***
	**Mass,** ***kilogram (kg)***
	**Time,** ***second (s)***
	**Temperature,** ***Kelvin (K)***
	**Current,** ***Ampere (A)***

DERIVED QUANTITIES

Define: are obtained from a combination of various base quantities and their unit is determined from the relation between the base quantities and the derived quantities.

EXAMPLE	QUANTITIES, *SI UNIT*
	**Area,** ***meter square(m^2)***
	**Acceleration,** ***meter/s^2 (m/s^2)***
	**Density,** ***kilogram / m^3 (kg/ m^3)***
	**Velocity,** ***mass/second (m/s)***
	**Pressure,** ***Pascal (Pa)***

SCALAR AND VECTOR QUANTITIES

SCALAR AND VECTOR QUANTITIES can be defined as :

SCALAR QUANTITIES

Define: Physical quantity which has **magnitude only.**

EXAMPLE QUANTITIES

- 01 DISTANCE
- 02 SPEED
- 03 MASS
- 04 VOLUME
- 05 TEMPERATURE

EXAMPLE

Harry Potter walks <u>500m.</u>

500m = **magnitude**

VECTOR QUANTITIES

Define: Physical quantity which **has magnitude and direction.**

EXAMPLE QUANTITIES

- 01 DISPLACEMENT
- 02 VELOCITY
- 03 WEIGHT
- 04 ACCELERATION
- 05 FORCE

EXAMPLE

Harry Potter walks <u>500m</u> to <u>lecture room.</u>

500m = **magnitude**

Lecture room = **direction**

SCALAR AND VECTOR QUANTITIES

State each of the questions either **SCALAR** or **VECTOR QUANTITIES** and tick (**√**) if the questions require **magnitude**, **direction** or **both** :

EXERCISE

QUESTIONS	Quantity	Magnitude	Direction
1. The temperature in a room is 27°C			
2. A cow moves 2 m to the east.			
3. The location of Kuantan is 250 km from Kuala Terengganu.			
4. The power of bulb is 15W.			
5. Luqman is travelling from Perak to Kedah at 100km/h.			

Answer:

1. Scalar Quantity, Magnitude: 27°C
2. Vector Quantity, Magnitude: 2 m & Direction: east
3. Vector Quantity, Magnitude: 250 km & Direction: Kuantan from Kuala Terengganu
4. Scalar Quantity, Magnitude: 15W
5. Vector Quantity, Magnitude: 100km/h & Direction : Perak to Kedah

CONSISTENCY, ACCURACY AND SENSITIVITY

CONSISTENCY

Ability of the measurement tools to get **consistent readings** when it is measured several times.

High consistency

1.0	1.0	1.1	1.0

Low consistency

1.5	1.0	2.0	1.8

ACCURACY

Ability of the measurement tools to get the **closest reading** to the actual reading

High accuracy

Low accuracy

SENSITIVITY

Ability of the measurement tools to **detect small changes** in a quantity measured.

High sensitivity

Low sensitivity

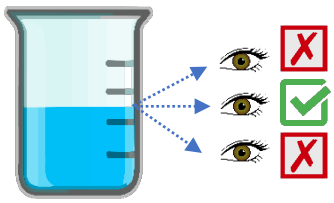
RANDOM ERROR AND SYSTEMATIC ERROR

There are two (2) mains of error:

RANDOM ERROR

An error which occurs when the observer is **reading the scale** on the measuring instrument.

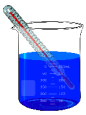
1 PARALLAX ERROR



2 ERROR IN THE READING SCALE

Starting with 0

3 ERROR DUE TO CHANGE IN TEMPERATURE

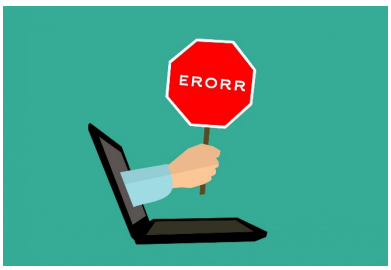


SYSTEMATIC ERROR

- are errors in the measurement of physical quantities.
- It is caused by **instrument, observer and surroundings**.

1 ZERO ERROR

occurs if the scale of the instruments does not begin with zero.

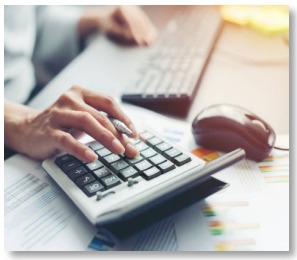


2 PERSONAL ERROR

this error is due to the physical constraints or limitations of the observer. Example, a runner is start running before the referee blow the whistle.

3 ERRORS IN THE INSTRUMENT

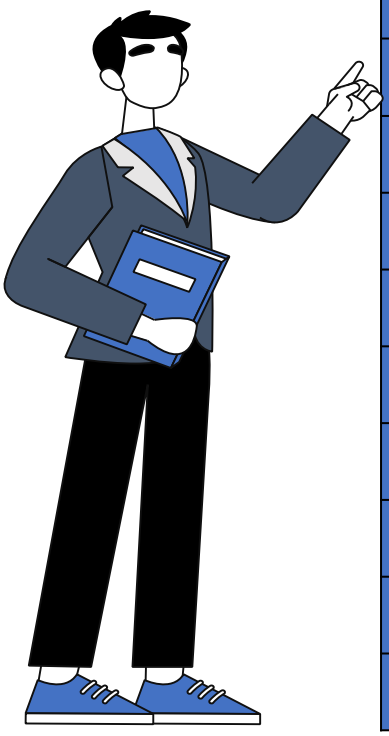
The damaged of the instruments or instruments in poor conditions.



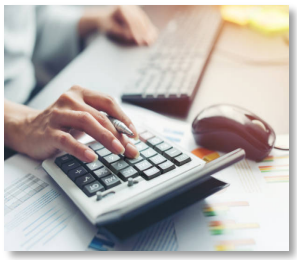
Metric Units and Customary Units

Units are a very important for a part of scientific values and calculations. Without units, the numbers scientists talk about have no meaning. For example, saying "Your temperature is 36.5" doesn't mean anything unless you attach a unit of measurement. "**Your temperature is 36.5 degrees Celsius**" means much more for science.

METRIC UNITS

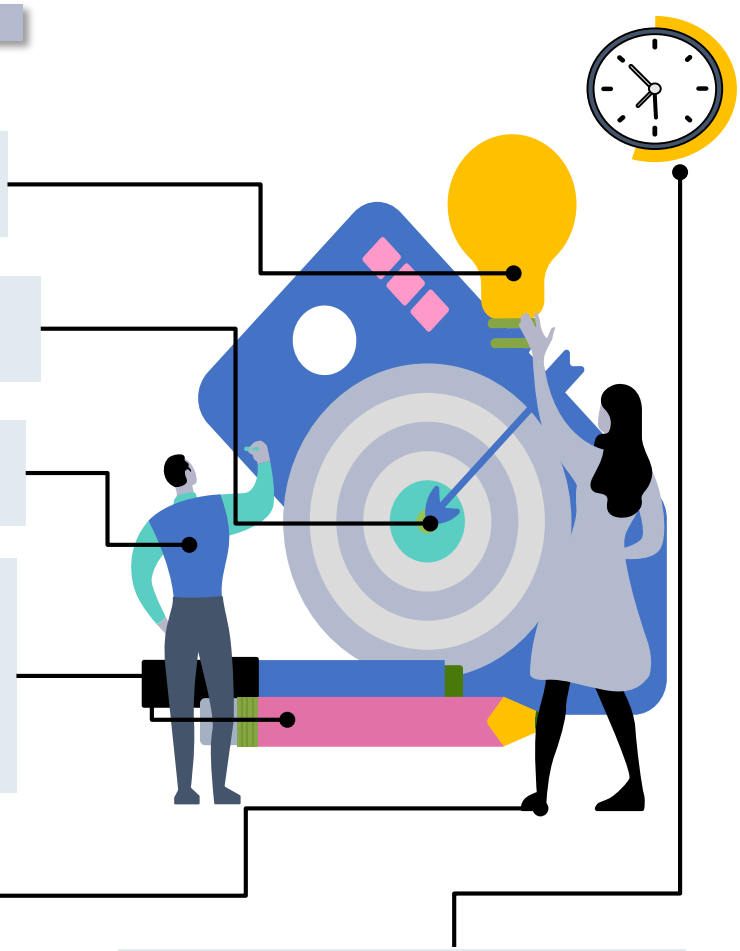


PREFIX	SYMBOL	POWER
Tera	T	10^{12}
Giga	G	10^{9}
Mega	M	10^{6}
Kilo	k	10^{3}
Deci	d	10^{-1}
Centi	c	10^{-2}
Mili	m	10^{-3}
Mikro	μ	10^{-6}
Nano	n	10^{-9}
Pico	p	10^{-12}



Metric Units and Customary Units

CUSTOMARY UNITS



POWER
- 1 kW ---- 1000 W

WORK/ENERGY
- 1 kJ ---- 1000 J

FORCE
- 1 kN ---- 1000 N

LENGTH
- 1 km ----1000 m
- 1 m ---- 100 cm
- 1 cm ---- 10 mm
- 1 km ---- 1000000 mm
- 1 m ---- 1000 mm

WEIGHT
- 1 kg ---- 1000 g

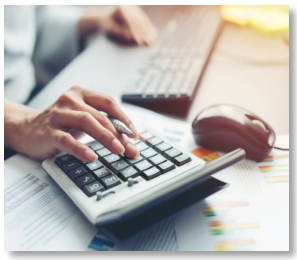
TIME
- 1 hour ---- 60 minutes
- 1 hour ---- 3600 s
- 1 min ---- 60 s

EXTRA NOTES

- 1 foot = 12 inches
- 1 inches = 2.54 cm
- 1 km = 0.621 miles
- 1 yard = 0.9144 m
- 1 oz = 28.35 g
- 1 gallons = 3.8 liters

SOLVE PROBLEMS OF UNIT CONVERSION

08



Metric Units and Customary Units

EXAMPLE :

Customary units

1. 220 km to miles

SOLVE:
1km = 0.621miles

220 ~~km~~	0.621miles
	1~~km~~

$= \frac{220 \times 0.621}{1}$
= 136.62miles

Customary with two (2) units

2. 700 kg/m^3 to g/cm^3

SOLVE:
1km = 1000g
1m = 100 cm

700~~kg~~	1000g	1~~m~~	1~~m~~	1~~m~~
~~m^3~~	1~~kg~~	100cm	100cm	100cm

$= \frac{700 \times 1000}{100 \times 100 \times 100}$
= 0.7 g / cm^3

Metric units

3. 0.25 kg to mg

SOLVE:
= 0.25 x ~~10^3 x 10^{-3}~~ g
= 0.25 x 10^6 mg
= 2.5 x 10^5 mg
** 3 – (-3) = 6

Customary with power of two (2)

4. 800 cm^2 to m^2

SOLVE:
1m = 100 cm

800~~cm^2~~	1m	1m
	100~~cm~~	100~~cm~~

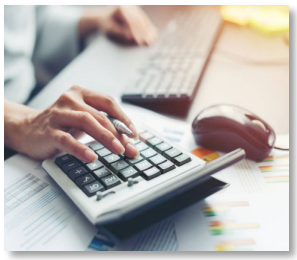
$= \frac{800 \times 1 \times 1}{100 \times 100}$
= 0.08 m^2

EXTRA NOTES

$$g/c\,m^2 = gcm^{-2}$$

$$kg/m^3 = kgm^{-3}$$

$$\frac{1}{m^2} = m^{-2}$$



Metric Units and Customary Units

EXERCISE :

Customary units

1. 450 N/m^2 to kN/mm^2
2. 50 gcm^{-3} to kgm^{-3}
3. 1.5 ft. to in
4. 8.7 m^2 to cm^2
5. 5200 oz^3 to g^3
6. 20 ms^{-2} to kmh^{-2}
7. 470 miles to km
8. 480 m/s to km/h
9. 700 km^2/h^2 to m^2/s^2
10. 0.280 g/cm^2 to kg/m^2
11. 10.2 yard to meter
12. 455 m^3 to cm^3
13. 160 km/h to m/s
14. 3.55 kg/m^3 to g/cm^3
15. 220 in^2 to cm^2

Metric units

1. 50 µg to g
2. 15 µm to m
3. 68 kA to A
4. 170 GW to MW
5. 1500 mg to kg

ANSWER:

Customary units

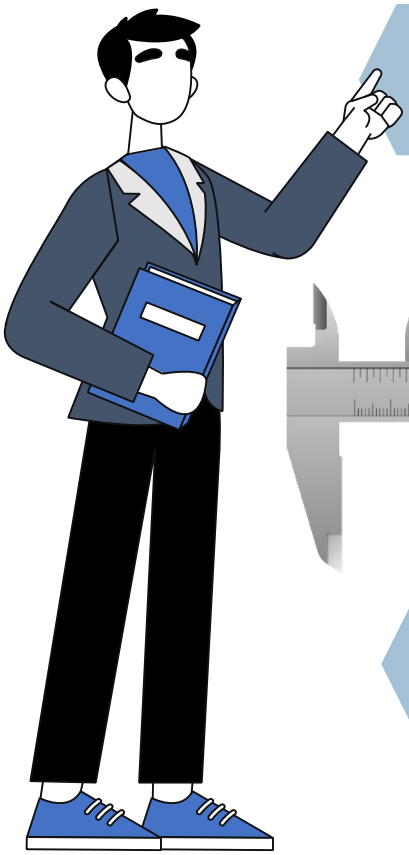
1. $4.5\times10^{-7}\,kN/mm^2$
2. $5.0\times10^{4}\,kgm^{-3}$
3. $18in$
4. $8.7\times10^{4}\,cm^2$
5. $118484770.95g^3$
6. $259200\ kmh^{-2}$
7. $756.844\,km$
8. $1728km/h$
9. $54.012m^2/s^2$
10. $2.80kg/m^2$
11. $9.327\,meter$
12. $4.55\times10^{4}\,cm^3$
13. $44.444m/s$
14. $3.55\times10^{-3}\,g/cm^3$
15. $1419.352cm^2$

Metric units

1. $5\times10^{-5}\,g$
2. $1.5\times10^{-5}\,m$
3. $68000A$
4. $1.7\times10^{5}\,MW$
5. $1.5\times10^{-5}\,kg$

The measurement reading from Vernier Calipers usage

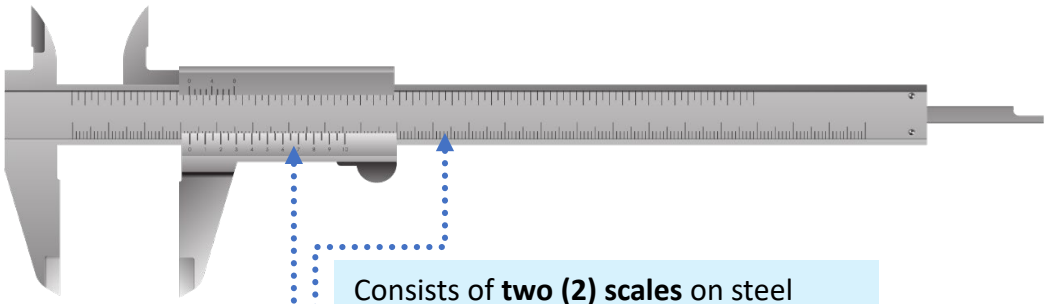
VERNIER CALIPER



1

- Used to measure a small object
- More accurate than ruler.

- An **accuracy** of up to **0.01 cm.**



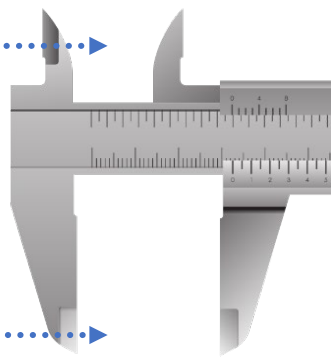
2

Consists of **two (2) scales** on steel bars:

- Main scale
- Vernier Scale

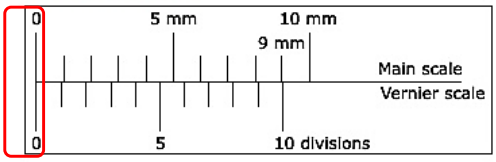
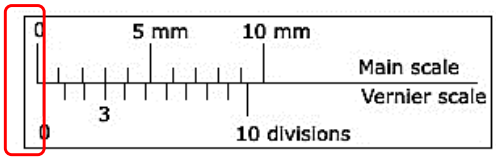
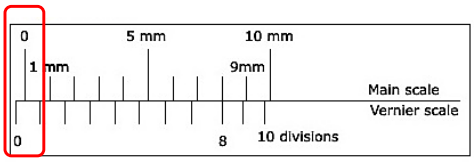
3

- There are **two (2) jaws**:
  - Measure **inside jaws**.
    Example: measure inner diameter of the coin.
  - Measure linear and **outside jaws.**
    Example: measure length of the wooden block



The measurement reading from Vernier Calipers usage

THREE (3) TYPES OF ERROR

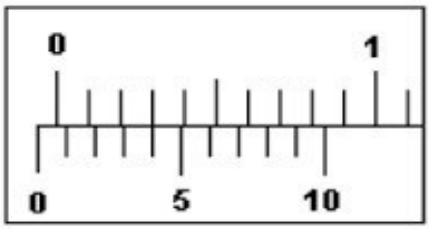
	TYPES	EXPLANATIONS	
ZERO ERROR Zero error occurs when the vernier calipers is set to its **closed position** **Extra Notes** 1. Taking reading at **Vernier Scale** 2. Vernier scale is small scales (value x 0.01cm)	NO ZERO ERROR		0.00 cm
	POSITIVE ERROR		+0.03 cm (read from front)
	NEGATIVE ERROR		- 0.02 cm (read from back)

READING OF MEASUREMENT TOOLS

The measurement reading from Vernier Calipers usage

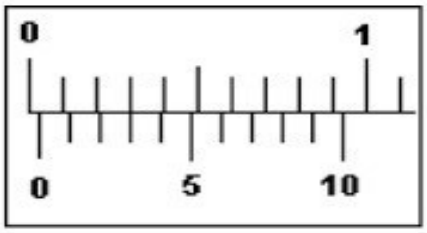
EXERCISE ZERO ERROR:

1.



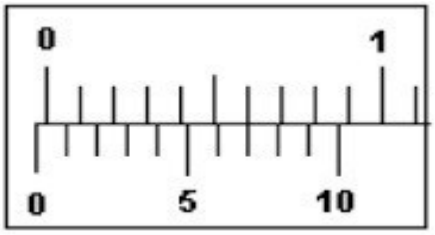
Answer =

2.



Answer =

3.



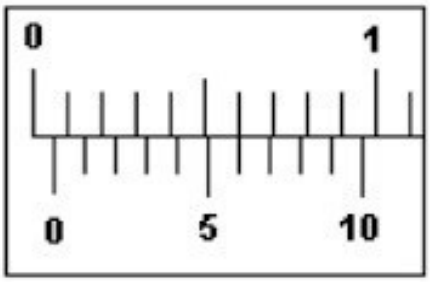
Answer =

ANSWER: **1.** - 0.06cm | **2.** + 0.03 cm | **3.** – 0.03 cm | **4.** – 0.04 cm | **5.** – 0.03 cm | **6.** + 0.1 cm

The measurement reading from Vernier Calipers usage

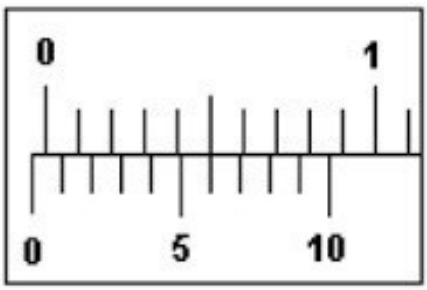
EXERCISE ZERO ERROR:

4.



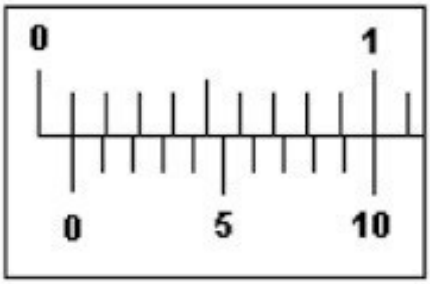
Answer =

5.



Answer =

6.

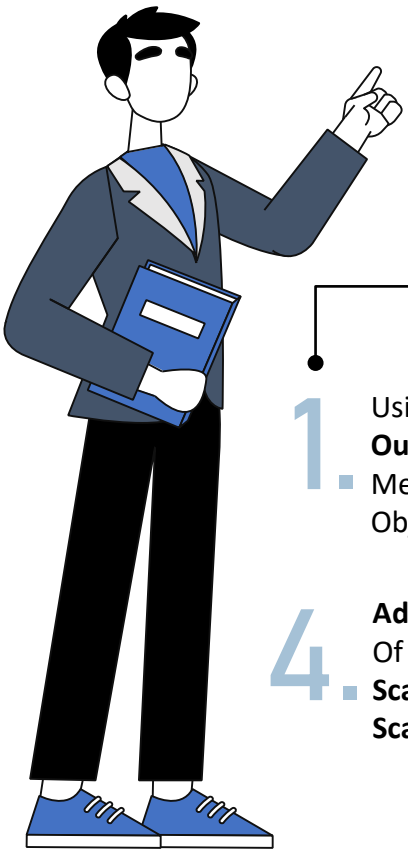


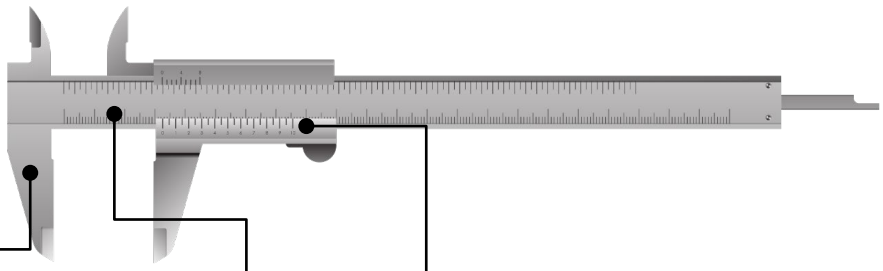
Answer =

ANSWER: **1.** - 0.06cm | **2.** + 0.03 cm | **3.** – 0.03 cm | **4.** + 0.06 cm | **5.** – 0.04 cm | **6.** + 0.1 cm

The measurement reading from Vernier Calipers usage

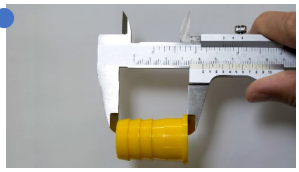
HOW TO READ VERNIER CALIPER

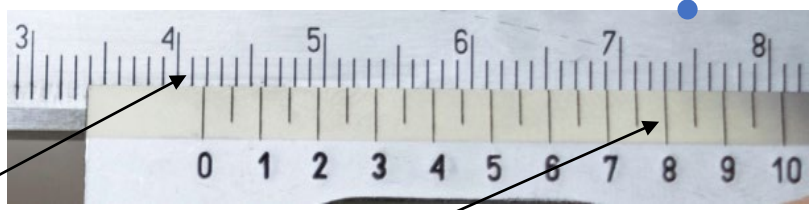




1. Using The **Outside Jaws** To Measure Small Object.
2. Read The **Main Scale**.
3. Read The **Vernier Scale**. [Value x **0.01cm**]
4. **Add** The Reading Of The **Main Scale** And **Vernier Scale**
5. **Unit** : **cm**
6. **Write** two (2) decimal places. [Example: 2.33cm]

EXAMPLE





MAIN SCALE = 4.1cm + **VERNIER SCALE = 8 x 0.01 = 0.08cm** =

$$\begin{array}{r} 4.1 \\ +0.08 \\ \hline 4.18\,cm \end{array}$$

The reading taken before the value 0 below.

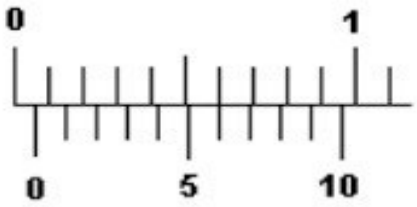
Vernier scale that lines up exactly with that of the main scale

ANSWER

The measurement reading from Vernier Calipers usage

EXERCISE READING VERNIER CALIPER:

1.

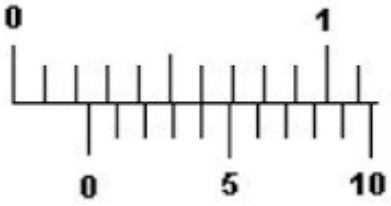


Main Scale =

Vernier Scale =

Answer =

2.

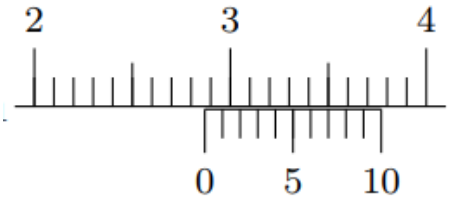


Main Scale =

Vernier Scale =

Answer =

3.



Main Scale =

Vernier Scale =

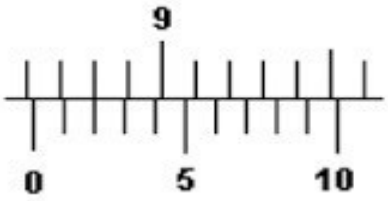
Answer =

ANSWER: **1.** 0.06cm | **2.** 0.24 cm | **3.** 2.87 cm | **4.** 8.62 cm | **5.** 6.43 cm | **6.** 1.06 cm | **7.** 5.31 cm | **8.** 7.05 cm | **9.** 3.83 cm | **10.** 4.27 cm

The measurement reading from Vernier Calipers usage

EXERCISE READING VERNIER CALIPER:

4.

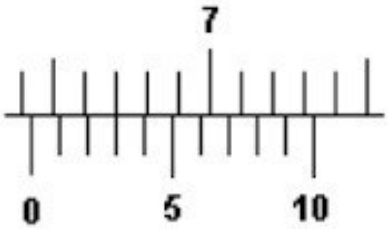


Main Scale =

Vernier Scale =

Answer =

5.

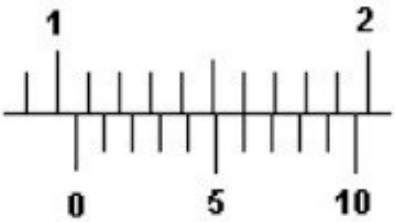


Main Scale =

Vernier Scale =

Answer =

6.



Main Scale =

Vernier Scale =

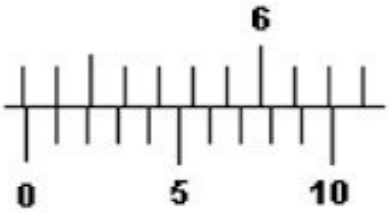
Answer =

ANSWER: **1.** 0.06cm | **2.** 0.24 cm | **3.** 2.87 cm | **4.** 8.62 cm | **5.** 6.43 cm | **6.** 1.06 cm | **7.** 5.31 cm | **8.** 7.05 cm | **9.** 3.83 cm | **10.** 4.27 cm

The measurement reading from Vernier Calipers usage

EXERCISE READING VERNIER CALIPER:

7.

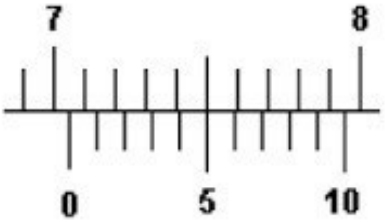


Main Scale =

Vernier Scale =

Answer =

8.

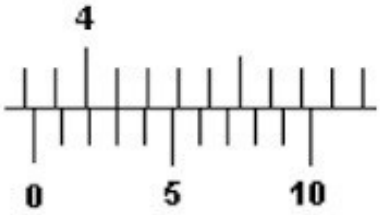


Main Scale =

Vernier Scale =

Answer =

9.

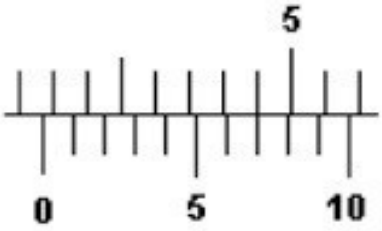


Main Scale =

Vernier Scale =

Answer =

10.



Main Scale =

Vernier Scale =

Answer =

ANSWER: **1.** 0.06cm | **2.** 0.24 cm | **3.** 2.87 cm | **4.** 8.62 cm | **5.** 6.43 cm | **6.** 1.06 cm | **7.** 5.31 cm | **8.** 7.05 cm | **9.** 3.83 cm | **10.** 4.27 cm

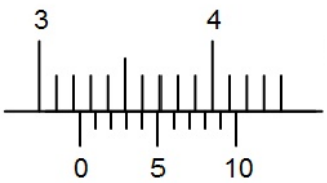
READING OF MEASUREMENT TOOLS

The measurement reading from Vernier Calipers usage

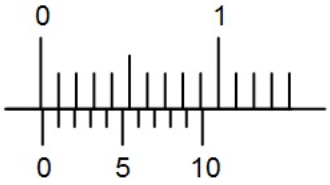
FORMULA ACTUAL READING

READING VERNIER CALIPER/ WITH OBJECT — ZERO ERROR / WITHOUT OBJECT = ACTUAL READING

EXAMPLE 1 : + ZERO ERROR



READING VERNIER CALIPER/ WITH OBJECT
= **3.24 cm**



ZERO ERROR / WITHOUT OBJECT
= **+0.01 cm**

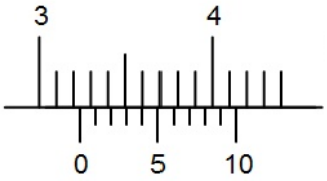
$3.24cm - (+0.01cm)$

$3.23cm$

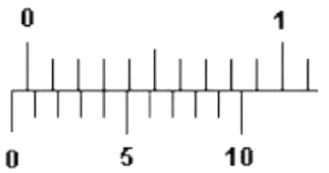
ANSWER

ACTUAL READING

EXAMPLE 2 : - ZERO ERROR



READING VERNIER CALIPER/ WITH OBJECT
= **3.24 cm**



ZERO ERROR / WITHOUT OBJECT
= **- 0.06 cm**

$3.24cm - (-0.06cm)$

$3.30cm$

ANSWER

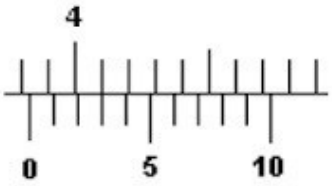
ACTUAL READING

READING OF MEASUREMENT TOOLS

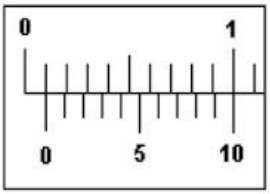
The measurement reading from Vernier Calipers usage

EXERCISE ACTUAL READING

1.



—



=

ACTUAL READING

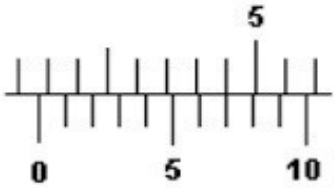
: .....

: .....

READING:.....

ZERO ERROR:.....

2.



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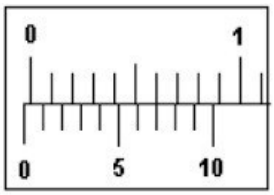


=

ACTUAL READING

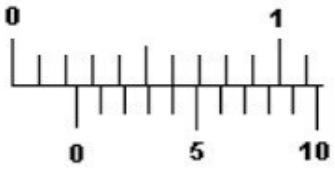
: .....

: .....

READING:.....

ZERO ERROR:.....

3.



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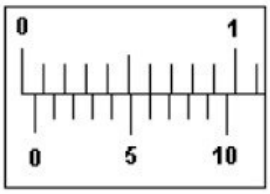


=

ACTUAL READING

: .....

: .....

READING:.....

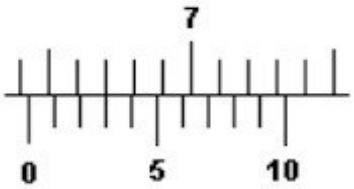
ZERO ERROR:.....

ANSWER (ACTUAL READING): **1.** 3.73cm | **2.** **4**.30 cm | **3.** **0**.18 cm | **4.** **6**.47 cm | **5.** **3**.80 cm | **5.** **1**.10 cm

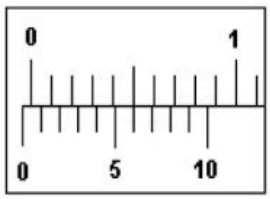
The measurement reading from Vernier Calipers usage

EXERCISE ACTUAL READING

4.



—



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ACTUAL READING

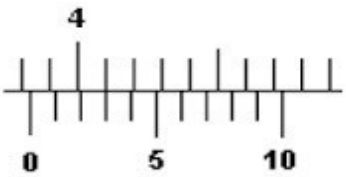
: .....

: .....

READING:.....

ZERO ERROR:.....

5.



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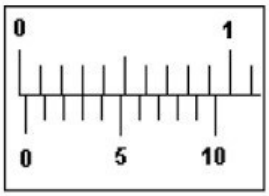

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ACTUAL READING

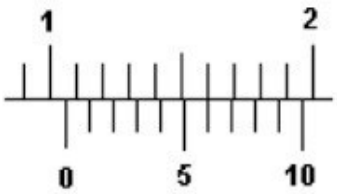
: .....

: .....

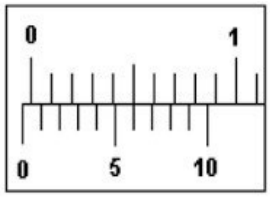
READING:.....

ZERO ERROR:.....

6.



—



=

ACTUAL READING

: .....

: .....

READING:.....

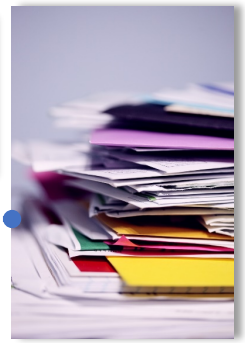
ZERO ERROR:.....

ANSWER (ACTUAL READING): **1.** 3.73cm | **2.** **4**.30 cm | **3.** **0**.18 cm | **4.** **6**.47 cm | **5.** **3**.80 cm | **5.** **1.1**0 cm

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

MICROMETER SCREW GAUGE



- Used to measure **VERY** small lengths such as:
  - Diameter of a wire
  - The thickness of a piece of paper
- 3. The precision of a micrometer screw gauge is higher than vernier calipers.

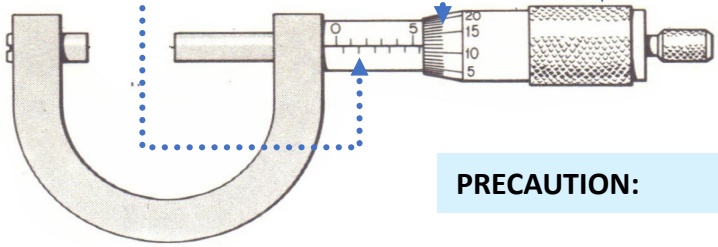
1

- An **accuracy** of up to **0.01 mm or 0.001 cm.**

2

Consists of **two (2) scales** on steel bars:

- Main scale / Sleeve
- Vernier Scale / Thimble
- Ratchet



PRECAUTION:

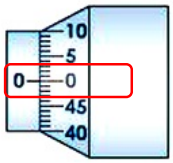
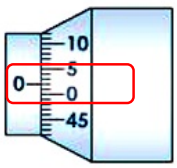
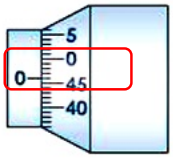
3

- The **thimble** is turned until the object is gripped very gently between the anvil and the spindle.
- The **ratchet** knob is then turned until a 'click' sound is heard.
- The **ratchet** knob is used to prevent the user from exerting undue pressure.

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

THREE (3) TYPES OF ERROR

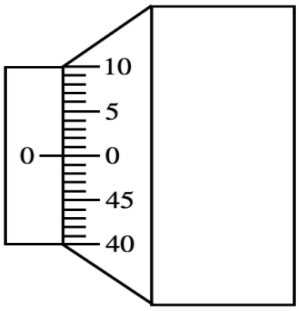
	TYPES	EXPLANATIONS	
ZERO ERROR Zero error occurs when the **Micrometer Screw Gauge** is set to its closed position	NO ZERO ERROR		0.00 mm
Extra Notes 1. Taking reading at **Vernier Scale** 2. Vernier scale is small scales (value x 0.01mm)	POSITIVE ERROR		+ 0.02 mm (Start reading at 0 in vernier scale)
	NEGATIVE ERROR		- 0.04 mm (Start reading at 0 in vernier scale)

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

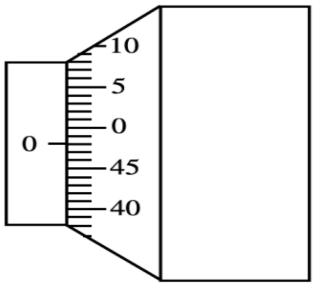
EXERCISE ZERO ERROR:

1.



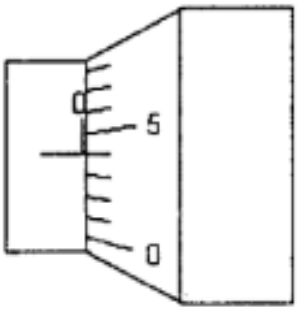
Answer =

2.



Answer =

3.



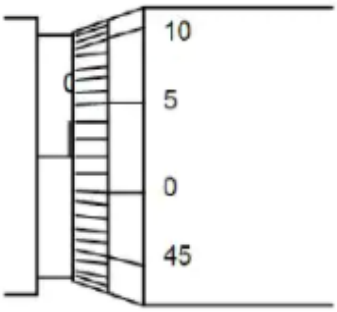
Answer =

ANSWER: **1.** 0.00mm | **2.** – 0.02 mm | **3.** + 0.04 mm | **4.** + 0.02 cm | **5.** – 0.03 mm | **6.** – 0.01 mm

The measurement reading from Micrometer Screw Gauge usage

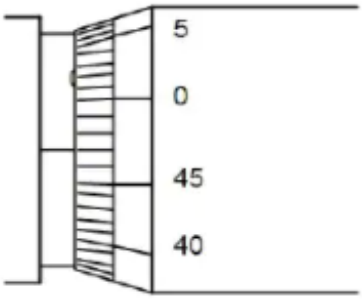
EXERCISE ZERO ERROR:

4.



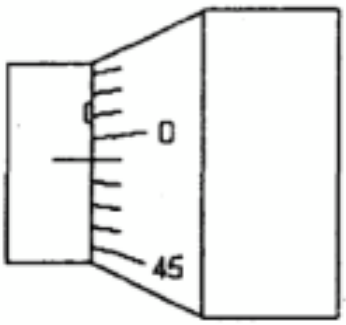
Answer =

5.



Answer =

6.



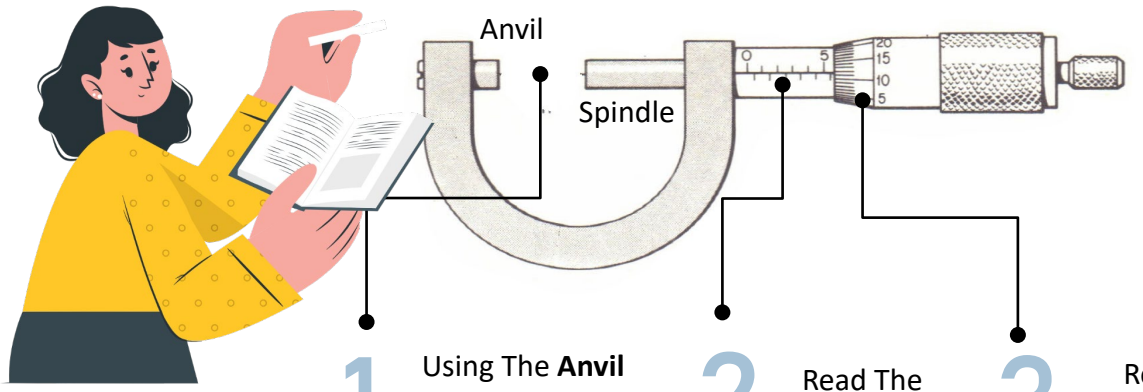
Answer =

ANSWER: **1.** 0.00mm | **2.** – 0.02 mm | **3.** + 0.04 mm | **4.** + 0.02 cm | **5.** – 0.03 mm | **6.** – 0.01 mm

READING OF MEASUREMENT TOOLS

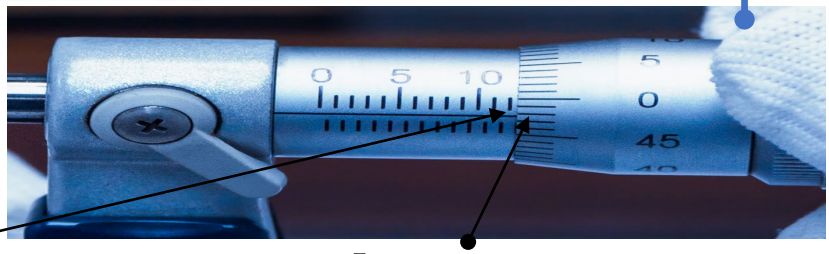
The measurement reading from Micrometer Screw Gauge usage

HOW TO READ MICROMETER SCREW GAUGE



1. Using The **Anvil and Spindle** To Measure An Object.
2. Read The **Main Scale / Sleeve**.
3. Read The **Vernier Scale / Thimble**. [Value x **0.01mm**]
4. **Add** The Reading Of The **Main Scale** And **Vernier Scale**
5. **Unit** : **mm**
6. **Write** two (2) decimal places. [Example: 2.33mm]

EXAMPLE



MAIN SCALE = 12.0mm + **VERNIER SCALE = 48 x 0.01 = 0.48mm** =

$$\begin{array}{r} 12.0 \\ +\ 0.48 \\ \hline 12.48\,mm \end{array}$$

The reading taken before the value 0 below.

Vernier scale that lines up exactly with that of the main scale

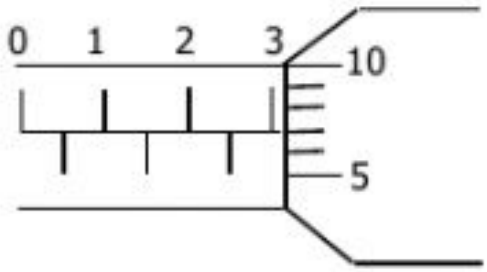
ANSWER

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

EXERCISE READING MICROMETER SCREW GAUGE

1.

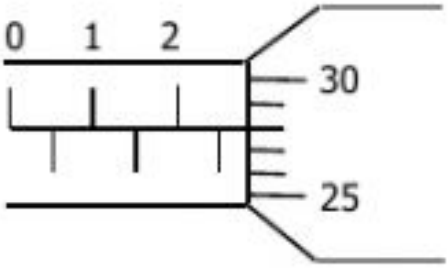


Main Scale =

Vernier Scale =

Answer =

2.

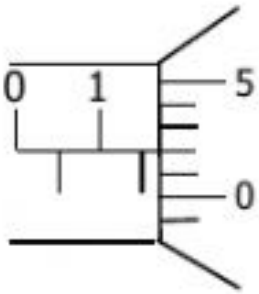


Main Scale =

Vernier Scale =

Answer =

3.



Main Scale =

Vernier Scale =

Answer =

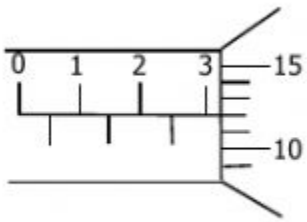
ANS: **1.** 3.07mm | **2.** 2.78mm | **3.** 1.53mm | **4.** 3.12mm | **5.** 3.47mm | **6.** 2.53mm | **7.** 2.63mm

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

EXERCISE READING MICROMETER SCREW GAUGE

4.

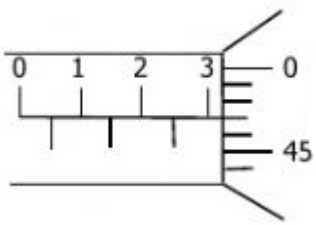


Main Scale =

Vernier Scale =

Answer =

5.



Main Scale =

Vernier Scale =

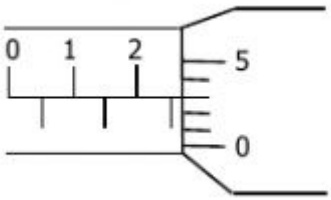
Answer =

ANS: **1.** 3.07mm | **2.** 2.78mm | **3.** 1.53mm | **4.** 3.12mm | **5.** 3.47mm | **6.** 2.53mm | **7.** 2.63mm

The measurement reading from Micrometer Screw Gauge usage

EXERCISE READING MICROMETER SCREW GAUGE

6.

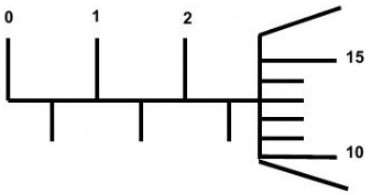


Main Scale =

Vernier Scale =

Answer =

7.



Main Scale =

Vernier Scale =

Answer =

ANS: **1.** 3.07mm | **2.** 2.78mm | **3.** 1.53mm | **4.** 3.12mm | **5.** 3.47mm | **6.** 2.53mm | **7.** 2.63mm

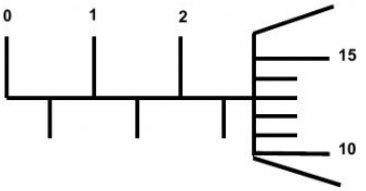
READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

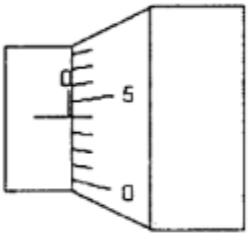
FORMULA ACTUAL READING

READING MICROMETER SCREW GAUGE/ WITH OBJECT — ZERO ERROR / WITHOUT OBJECT = ACTUAL READING

EXAMPLE 1 : + ZERO ERROR



READING MICROMETER SCREW GAUGE/ WITH OBJECT
= **2.63 mm**



ZERO ERROR / WITHOUT OBJECT
= **+0.04 mm**

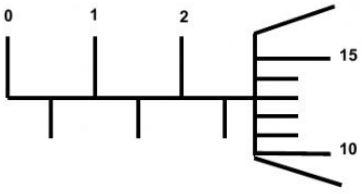
$$2.63mm - (+0.04mm)$$

$$2.59\ mm$$

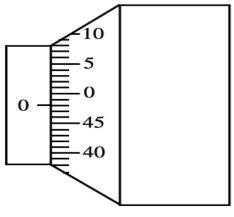
ANSWER

ACTUAL READING

EXAMPLE 2 : - ZERO ERROR



READING MICROMETER SCREW GAUGE/ WITH OBJECT
= **2.63 mm**



ZERO ERROR / WITHOUT OBJECT
= **- 0.02 mm**

$$2.63mm - (-0.02mm)$$

$$2.65\ mm$$

ANSWER

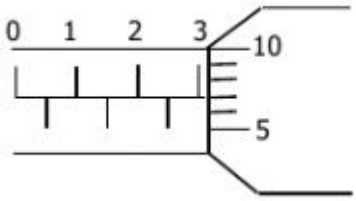
ACTUAL READING

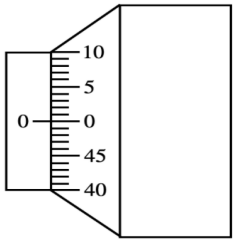
READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

EXERCISE ACTUAL READING

1.





ACTUAL READING

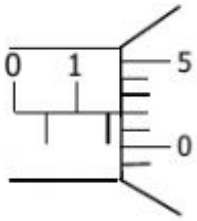
: .....

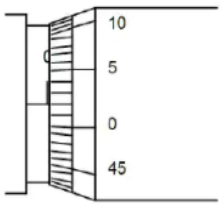
: .....

READING:.....

ZERO ERROR:.....

2.





ACTUAL READING

: .....

: .....

READING:.....

ZERO ERROR:.....

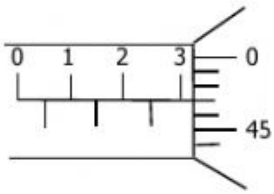
ANSWER (ACTUAL READING): **1.** 3.73cm | **2.** **4**.30 cm | **3.** **0**.18 cm | **4.** **6**.47 cm | **5.** **3**.80 cm | **6.** 3.08 cm

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

EXERCISE ACTUAL READING

3.



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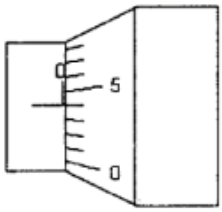


= ACTUAL READING

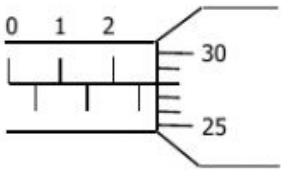
: .....

: .....

READING:.....

ZERO ERROR:.....

4.



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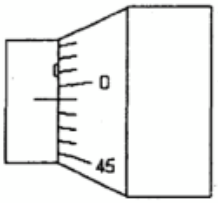


= ACTUAL READING

: .....

: .....

READING:.....

ZERO ERROR:.....

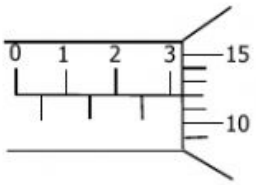
ANSWER (ACTUAL READING): **1.** 3.73cm | **2.** 4.30 cm | **3. 0**.18 cm | **4. 6**.47 cm | **5. 3**.80 cm | **6.** 3.08 cm

READING OF MEASUREMENT TOOLS

The measurement reading from Micrometer Screw Gauge usage

EXERCISE ACTUAL READING

5.



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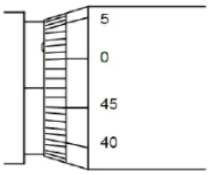

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ACTUAL READING

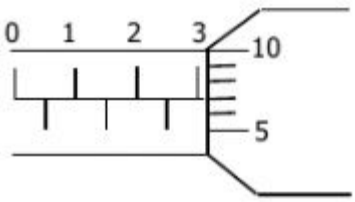
: .....

: .....

READING:.....

ZERO ERROR:.....

6.



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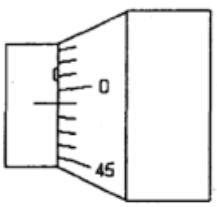

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ACTUAL READING

: .....

: .....

READING:.....

ZERO ERROR:.....

ANSWER (ACTUAL READING): **1.** 3.73cm | **2.** **4**.30 cm | **3.** **0**.18 cm | **4.** **6**.47 cm | **5.** **3**.80 cm | **6.** 3.08 cm

QUESTION COLLECTION

Base quantities, derived quantities and the International System (SI) of units

1. Define the following terms and state ONE (1) example for each:
   i. Base Quantity
   ii. Derived Quantity

2. Give the definition of Physical Quantity with TWO (2) examples.

3. List down FOUR (4) base quantities and FOUR (4) derived quantities and its SI unit.

Scalar And Vector Quantities

1. Define the following terms and state ONE (1) example for each:
   i. Vector Quantity
   ii. Scalar Quantity

2. State each quantity below either as vector or a scalar.
   i. 50.2 meter
   ii. 30 m/sec, London
   iii. 5 Kilometer, North
   iv. -20 degrees Celsius

3. State a description of events below whether it is scalar quantity or vector quantity.
   i. The power of bulb is 12 Watt
   ii. Johan is driving from Perak to Kedah at 100 km/h.
   iii. Ali is walking 3 km to school.

Metric Units and Customary Units

Convert the following units:

i. 70 cm^2 to m^2

ii. 500 km/h to m/s

iii. 2500 kV to MV

iv. 12 μm to m

v. 45 m^3 to cm^3

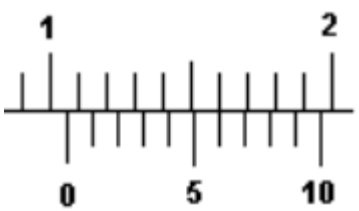
vi. 300 gcm^{-3} to kgm^{-3}

vii. 280 N/m^2 to kN/mm^2

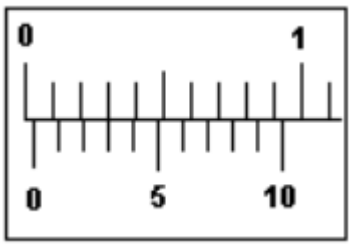
viii. 2 days to second

The measurement reading from Vernier Calipers usage

1. Figure below shows diameter measurement of a coin by using a Vernier Caliper. Calculate the value for zero error of the Vernier caliper and the actual reading of the coin.



Coin diameter

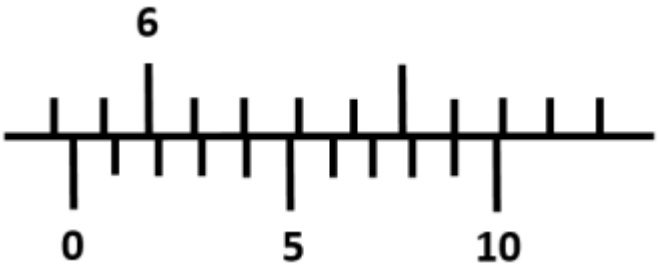


Zero error

The measurement reading from Vernier Calipers usage

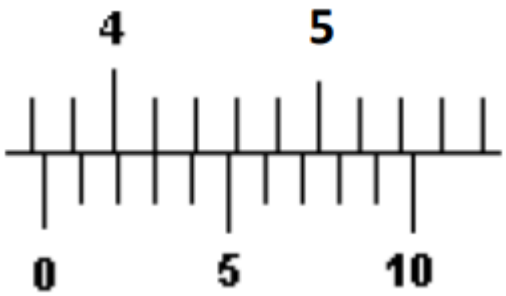
2. Determine the reading of the following measurement tools.

Has a Zero error = +0.05cm



3. Determine the reading of the following measurement tools.

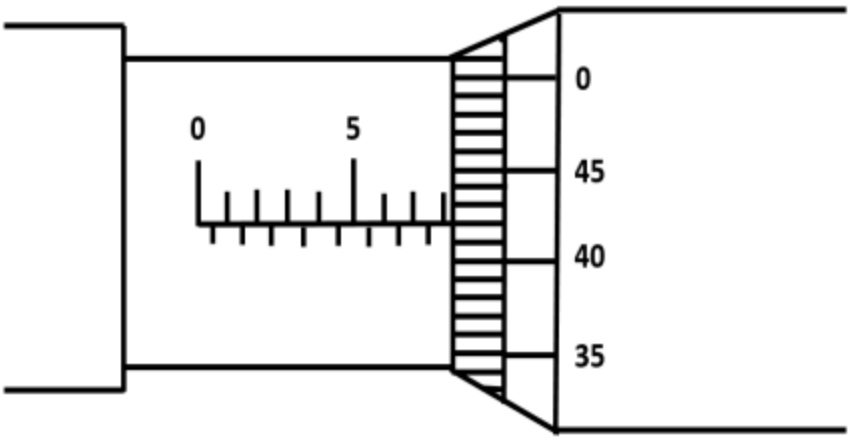
Has a Zero error = -0.03cm



The measurement reading from Micrometer Screw Gauge usage

1. Determine the reading of the following measurement tools.

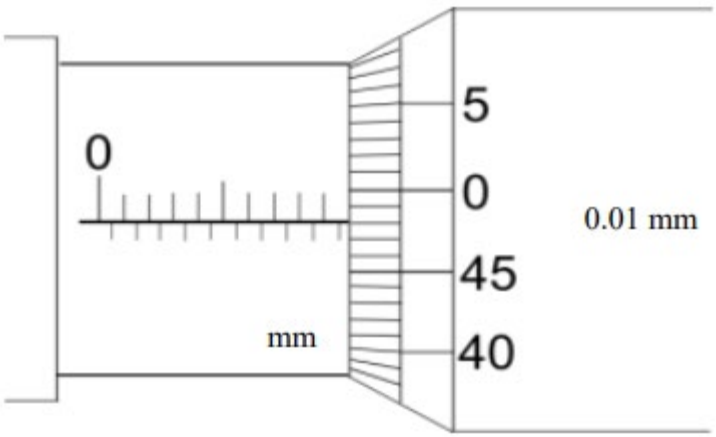
   Has a Zero error = -0.07mm



2. Figure below shows the use of a micrometer screw gauge to measure the diameter of a steel round bar. Calculate the diameter of a steel round bar if the micrometer screw gauge has a zero error of:

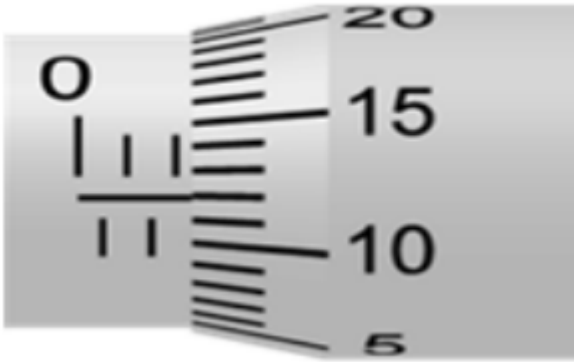
   i. +0.02mm

   ii. -0.09mm

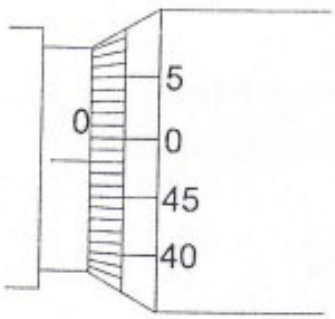


The measurement reading from Micrometer Screw Gauge usage

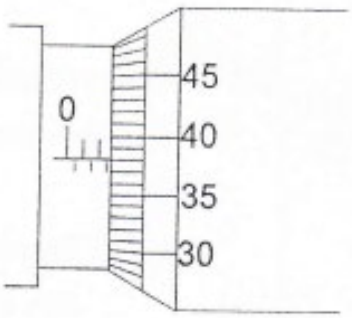
3. Determine the reading of the following measurement tools by stating the scientific notation.



4. Determine the readings for the following tools in mm.



Without an object



With an object

ANSWER QUESTION COLLECTION

Base quantities, derived quantities and the International System (SI) of units

1. Define the following terms and state ONE (1) example for each:

   i. Base Quantity physical quantity that cannot be expressed in terms of other physical quantities. Example : time

   ii. Derived Quantity are obtained from a combination of various base quantities and their unit is determined from the relation between the base quantities and the derived quantities. Example : Velocity

2. Give the definition of Physical Quantity with TWO (2) examples.

   Defined as quantity that can be measured by measurement.

   Examples: length and density.

3. List down FOUR (4) base quantities and FOUR (4) derived quantities and its SI unit.

   FOUR (4) base quantities

   1. length, meter
   2. time, second
   3. current, Ammeter
   4. mass, kg

   FOUR (4) derived quantities

   1. Velocity, m/s
   2. Density, kg/m^3
   3. Area, m^2
   4. Energy, J

Scalar And Vector Quantities

1. Define the following terms and state ONE (1) example for each:

   i. Vector Quantity : Physical quantity which has **magnitude and direction**.

   Example: Displacement

   ii. Scalar Quantity : Physical quantity which **has magnitude only.**

   Example : Distance

2. State each quantity below either as vector or a scalar.

   i. 50.2 meter

   Scalar Quantity

   ii. 30 m/sec, London

   Vector Quantity

   iii. 5 Kilometer, North

   Vector Quantity

   iv. -20 degrees Celsius

   Scalar Quantity

3. State a description of events below whether it is scalar quantity or vector quantity.

   i. The power of bulb is 12 Watt

   Scalar Quantity

   ii. Johan is driving from Perak to Kedah at 100 km/h.

   Vector Quantity

   iii. Ali is walking 3 km to school.

   Scalar Quantity

Metric Units and Customary Units

Convert the following units:

i. 70 cm^2 to m^2

$0.007m^2$

ii. 500 km/h to m/s

138.889m/s

iii. 2500 kV to MV

2.5MV

iv. 12 μm to m

$1.2x10^{-5}m$

v. 45 m^3 to cm^3

$4.5x10^7cm^3$

vi. 300 gcm^{-3} to kgm^{-3}

$300000kgm^{-3}$

vii. 280 N/m^2 to kN/mm^2

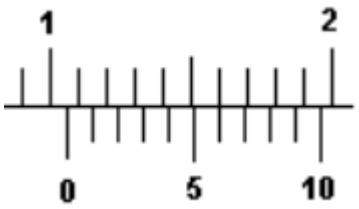
$2.8x10^{-7}kN/mm^2$

viii. 2 days to second

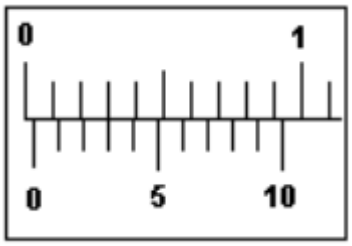
172800 second

The measurement reading from Vernier Calipers usage

1. Figure below shows diameter measurement of a coin by using a Vernier Caliper. Calculate the value for zero error of the Vernier caliper and the actual reading of the coin.



Coin diameter

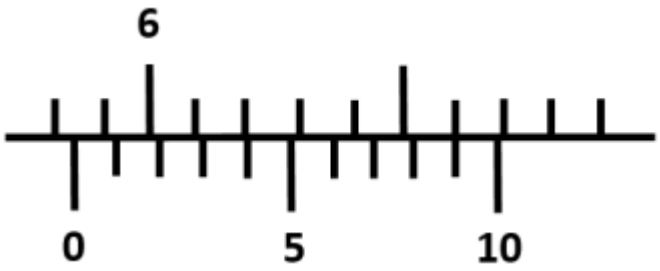


Zero error

Actual Reading: 1.03cm

2. Determine the reading of the following measurement tools.

Has a Zero error = +0.05cm

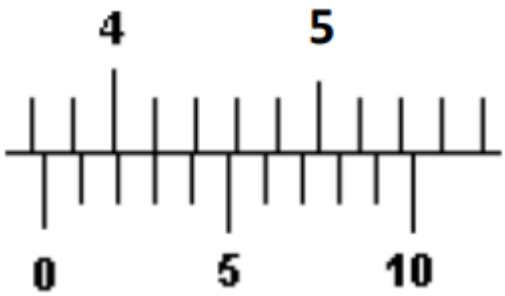


Actual Reading: 5.84cm

The measurement reading from Vernier Calipers usage

3. Determine the reading of the following measurement tools.

Has a Zero error = -0.03cm

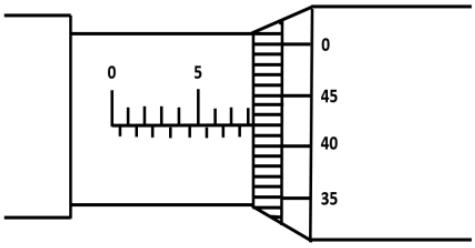


Actual Reading: 3.86cm

The measurement reading from Micrometer Screw Gauge usage

1. Determine the reading of the following measurement tools.

Has a Zero error = -0.07mm



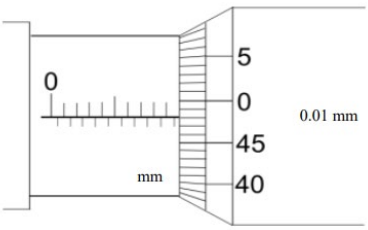
Actual Reading: 8.49mm

The measurement reading from Micrometer Screw Gauge usage

2. Figure below shows the use of a micrometer screw gauge to measure the diameter of a steel round bar. Calculate the diameter of a steel round bar if the micrometer screw gauge has a zero error of:

   i. +0.02mm

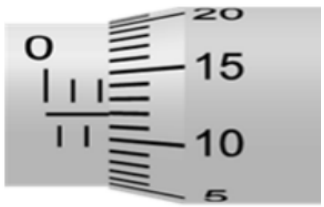
   ii. -0.09mm



i. Actual Reading: 9.96mm

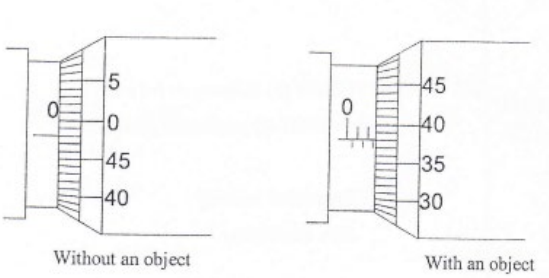
ii. Actual Reading: 10.07mm

3. Determine the reading of the following measurement tools by stating the scientific notation.



Reading: 2.12mm

4. Determine the readings for the following tools in mm.



Actual Reading: 2.90mm

REFERENCES

Main reference supporting the course

Azia Idayu Awang, Azhari Zakaria, Hardyta Bujang Pata, Khairani Yaakub, Noor
Affandee Abdul. (2015). Engineering Science, Polytechnic Series. Shah Alam:
Oxford Fajar Sdn. Bhd.

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Giambattista, A. , Richardson, B. , Richardson, R.C. (2016). Physics Third Edition.
McGraw-Hill Education.

Lee, B. H. and Poh, L. Y. (2016). Physics for Matriculation Semester 1 Fifth Edition. Shah
Alam: Oxford Fajar Sdn. Bhd.

NOTES

NOTES

Terbitan

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KUALA TERENGGANU

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