

Metric Mastery

Description	Competitors will estimate and measure properties (mass, area, volume, density, force, perimeter, distance, time and temperature) of objects. Students will also perform metric unit conversions.
Time Limit	Approximately 40 minutes
Team Size	1 Student
Details	<ul style="list-style-type: none"> ➤ The event will be divided into 3 parts. ➤ Competitors may not bring any of their own materials except for a pencil and a calculator for parts 2 and 3. ➤ An identical equation and prefix “cheat sheet” will be provided to each competitor. Competitors may not bring their own notes. ➤ Part 1: Estimation <ul style="list-style-type: none"> ○ Competitors will be asked to estimate distance, volume and mass. ○ Competitors must not touch or feel any of the objects, unless the station directions specifically state the object may be touched. ○ To receive points, estimated measurements must contain units. ➤ Part 2: Measurement <ul style="list-style-type: none"> ○ Measurements must be made with supplied instruments. ○ Measurements may include distance, mass, perimeter area, volume, density, force, degrees (angles) time and temperature ○ To receive points, measurements must be expressed using the proper number of digits based on the specificity of the measurement tool. One digit of estimation is allowed. ○ To receive points, measurements must include units. ➤ Part 3: Metric Unit Conversion <ul style="list-style-type: none"> ○ This part must be completed after parts 1 and 2. ○ Competitors will be asked to convert from one metric unit to another and will not be asked to convert from one measurement system to another.



Competition Scoring	<ul style="list-style-type: none"> ➤ Part One: Estimation <ul style="list-style-type: none"> ○ Scores within 10% of the correct value will be awarded 2 points and within 20% will be awarded 1 point. ○ 0 points will be awarded if the estimation does not include units. ➤ Part Two: Measurements <ul style="list-style-type: none"> ○ Measurements not involving calculation that are +/- 3 of the estimated digit will receive 3 points. Measurements that are +/- 5 of the estimated digit will receive 2 points, Measurements that are +/- 8 will receive 1 point. ○ Measurements that require formula calculations will receive 3 points if they fall within the range of the calculated value based on +/- 3 of the direct measurements. Two points will be awarded if the calculated value falls within +/- 5 of the direct measurements and one point if the calculated value falls within +/- 8 of the direct measurements. ○ 0 points will be awarded if the measurement does not include units. ➤ Part Three: Metric Unit Conversion <ul style="list-style-type: none"> ○ Correct answers receive 1 point. ➤ Total Points: 50 Points
Notebook Requirements	<ul style="list-style-type: none"> ➤ Metric Mastery Practice Packet ➤ Notebook Points: 20
Timeline	Lesson Dates: Practice Test: Competition Date: _____

Metric Mastery Formulas and Prefixes

$$\text{Density} = \frac{M}{V}$$



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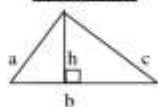
PERIMETER & AREA FORMULAS

SQUARE



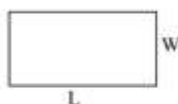
$$P = 4s$$
$$A = s^2$$

TRIANGLE



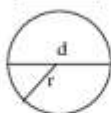
$$P = a + b + c$$
$$A = \frac{1}{2}bh \quad \text{OR} \quad A = \frac{bh}{2}$$

RECTANGLE



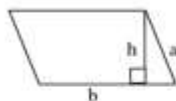
$$P = 2L + 2W$$
$$A = LW$$

CIRCLE



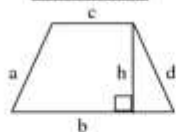
$$C = \pi d \quad \text{OR} \quad C = 2\pi r$$
$$A = \pi r^2$$

PARALLELOGRAM



$$P = 2a + 2b$$
$$A = bh$$

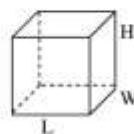
TRAPEZOID



$$P = a + b + c + d$$
$$A = \frac{1}{2}h(b + c)$$

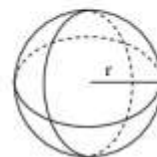
VOLUME FORMULAS

RECTANGULAR SOLID



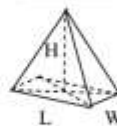
$$V = LWH$$

SPHERE



$$V = \frac{4}{3}\pi r^3 \quad \text{OR}$$
$$V = \frac{4\pi r^3}{3}$$

RECTANGULAR PYRAMID



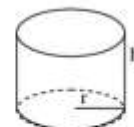
$$V = \frac{1}{3}LWH \quad \text{OR} \quad V = \frac{LWH}{3}$$

RIGHT CIRCULAR CONE



$$V = \frac{1}{3}\pi r^2 h$$
$$\text{OR} \quad V = \frac{\pi r^2 h}{3}$$

RIGHT CIRCULAR CYLINDER



$$V = \pi r^2 h$$



SCIENCE OLYMPIAD

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Common Prefixes used with SI Units			
Prefix	Symbol	Meaning	Order of Magnitude
<i>giga-</i>	G	1 000 000 000	10^9
<i>mega-</i>	M	1 000 000	10^6
<i>kilo-</i>	k	1 000	10^3
<i>hecto-</i>	h	100	10^2
<i>deka-</i>	da	10	10^1
	base unit	1	10^0
<i>deci-</i>	d	0.1	10^{-1}
<i>centi-</i>	c	0.01	10^{-2}
<i>milli-</i>	m	0.001	10^{-3}
<i>micro-</i>	μ	0.000 001	10^{-6}
<i>nano-</i>	n	0.000 000 001	10^{-9}

Table 1: Basic Units used in IGCSE

Quantity measured	Basic Unit	Symbol
Time	Second	s
Mass	Grams	g
Distance	Meter	m
Volume	Liter or cubic-meter	L or m^3
Force	Newton	N
Energy	Joule	J
Power	Watt	W
Current	Ampere	A
Potential Difference	Volt	V
Resistance	Ohm	Ω
Pressure	Pascal	Pa
Frequency	Hertz	Hz
Number	Mole	mol

