O-Level Physics

Notes

2nd Edition
According to CAIE New Syllabus

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Additional Features

Basic concepts are explained in simple language
Practice Questions after each chapter
Definitions are separately given
ATP related material is given
Formula sheet is attached
Symbols of physical quantities

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Chapter - 1

Measurements

Systems of Measurements

i. M.K.S. (Meter, Kilogram and Second System) (S.I)

Length in meters (m)

Mass in Kilogram (kg)

Time in Seconds (s)

ii. C.G.S.

Length in Centimeters (Centimeter, Gram and Second System))

Mass in grams (g)

Time in seconds (s)

Physical Quantities

The quantities which are measureable is called physical quantities

i) ***Fundamental Physical Quantities:*** *The quantities which are basic quantities, i.e. length, mass, time, temperature, current, quantity of substance and intensity of light.*

ii) ***Derived Physical Quantities:*** *The quantities which are derived from the basic quantities i.e. speed, acceleration, weight etc.)*

Quantities and S.I. Units

1- Fundamental Quantities		2- Derived Quantities	
Quantities	**S.I.Units**	**Quantities**	**S.I.Units**
Length	m	Area	m^2
Mass	Kg	Volume	m^3
Time	s	Density	Kg/m^3
Temperature	K	Weight	N
Current	A	Force	N
Quantity of Substance	mol	Speed / Velocity	ms^{-1}
Intensity of light	cd	Acceleration,deceleration/retardation	ms^{-2}
		Moment	Nm
		Work / Energy	J
		Power	W / (J/S)

		Pressure	N/m^2 (Pa)
		Heat Capacity	J/k
		Specific heat Capacity	J/Kg.K
		Latent heat	J/Kg
		Frequency	Hz (1/s)
		Charge	C
		Resistance	Ω (ohm)
		Voltage/P.d/emf	V(volt)or J/C
		Practical unit of Electric Energy	KWh
		Rate of decay	C/s

Prefixes

Multiples or sub-multiples of S.I units are called prefixes

Multiples:

10^3 Kilo-K (1000)

10^6 Mega-M (1000000)

10^9 Giga-G (1000000000)

Sub. Multiples:

10^{-3} Milli-m (1/1000)

10^{-6} Micro-μ (1/1000000)

10^{-9} Nano-n (1/1000000000)

1km 1000m

1m 100 cm

1cm 10 mm

$1m^2$ 10000 cm^2

$1m^3$ 1000000 cm^3

Conversion of Units

i. When big unit is converted into small unit then multiply it by a factor
e.g. 1.5 km = 1.5 x 1000 m

$$90\ km/h\ = \frac{90\ x\ 1000}{3600} m/s = 25\ m/s$$

ii. When small unit is converted into big unit then divide it by a factor
e.g. 60 cm = 60/100m

$$20\ m/s\ = \frac{20\ /\ 1000}{1/3600} km/h = 72\ km/h$$

Measurement of Length

Devices Used;

i. Measuring tape.

Accuracy = 1mm
Range = 100m

- It is used to measure curved lengths e.g; circumference and longer straight lengths

ii. Meter rule

Accuracy = 1mm
Range = 1m = 100 cm

- It is used to measure straight lengths, widths and heights within 100 cm.

iii. Vernier calipers

Accuracy = 0.1mm = 0.01cm
Range = 15 cm

- It is used to measure internal, external diameters of cylinders and its depth.

iv. Micrometer/Screw Gauge

Accuracy = 0.01 mm
Range = 5 cm

- It is used to measure thickness of coin, paper sheet and diameter of thin wire.

Zero Error: *It is an error of the device. When jaws of vernier caliper are closed without an object placed in the jaws zero on main scale and vernier scale do not coincide with each other, the difference between these zeros is called zero error. It may be positive or negative. Positive error is subtracted and negative error is added in the reading.*

Measurement of Mass

Beam Balance / Scale / electronic balance are used to measure mass.

Mass

Quantity of matter is called mass

1 g = 1000 mg
1 kg = 1000 g
1 ton = 1000 kg

Measurement of Time

i. Analogue clock / Needle's clock

Parallax error due to gap between scale and needles causes in accurate readings.

Its accuracy is 1s. Human reaction time error also causes an error.

ii. Digital clock / stop watch

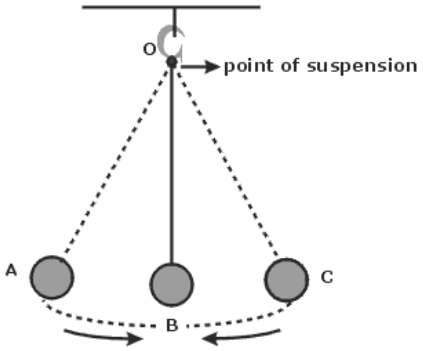
No parallax errors so gives accurate time. Its accuracy is 0.01s. But human reaction time causes an error

iii. Millisecond timer.

It gives more accurate time as its accuracy is 0.001s.

1 h = 60 min = 3600 s

Pendulum



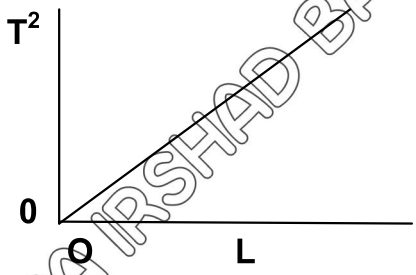
i. Mass should be hung freely
ii. Start clock when pendulum is at position 'B' as its speed is maximum
iii. Potential Energy maximum at 'A' and 'C' Kinetic Energy maximum at B
iv. Take time for 20 oscillations and divide by 20 to get time period.

$$T = \frac{t_{(20)}}{20}(s)$$

As time for one oscillation is too small so can't be measured accurately.

No	Length (cm)	T/s	T^2
1			
2			
3			

- Time period depends on length and gravity, i.e; $L \propto T^2$ and $T^2 \propto (1/g)$
- Time period does not depend on mass of bob of pendulum.
- In winter length of pendulum gets shorter and it gains time.
- In summer length gets longer and it loses time.



Scalars:

Physical quantity represented by magnitude and a suitable unit is called scalar, e.g. 4kg mass. 4 is magnitude (size) and Kg is S.I. Unit.

List of Scalars: Mass, Times, Temperature, Volume, Area, Density, Distance, Speed, Work, Power, Energy, Charge, Voltage, Resistance

Vectors:

Physical quantity represented by magnitude, a suitable unit and direction is called vector, e.g., 20 m/s to North (velocity)

List of Vectors: Displacement, Velocity, Acceleration, Weight, Force, Moment, Pressure, Current.