BBMerlion

Physics A level

Exam Format (Base on UEE 2013)

NTU

There will be one **2-hour** paper consisting of **two sections**:

Section A

Section A consists of 30 multiple choice questions (2 marks each). Candidates will be required to answer all the questions.

Section B

Section B consists of 4 questions (total 40 marks). Candidates will be required to answer all the questions.

NUS

The UEE Physics paper has a total of **50 multiple-choice** questions . Candidates are required to answer all questions.

Syllabus and Sample Paper (Base on UEE 2013)

NTU

Syllabus:
http://www3.ntu.edu.sg/oad2/EE%20Questions/Physics_syllabus_2012.pdf

Sample Paper:
http://www3.ntu.edu.sg/oad2/EE%20Questions/Physics_Sample_2010.pdf

NUS

Syllabus:
http://www.nus.edu.sg/iw/resources/oam/misc/uee/syllphysics.pdf

Sample Paper:
http://www.nus.edu.sg/iw/resources/oam/misc/uee/phy.pdf
And
http://www.nus.edu.sg/iw/resources/oam/misc/uee/PHYSICS%202.pdf

Measurement

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Learning Objectives

Understand the application of SI units

Understand the application of errors and uncertainties

Understand the application of scalars and vectors quantity

SI Units

- Base Units

Unit Name	Unit Symbol	Dimension Symbol	Quantity Name
Metre	m	L	Length
Kilogram	kg	M	Mass
Second	s	T	Time
Ampere	A	I	Electric Current
Kelvin	K	θ	Thermodynamic Temperature
Mole	mol	N	Amount of Substance
Candela	cd	J	Luminous Intensity

SI Units

- Derived Units

Created by powers, products or quotients of the base units (eg. Pressure, pascal (Pa) = $kg \cdot m^{-1} \cdot s^{-2}$)

Example

Determine the dimension and SI unit of Thermal Conductivity

SI Units

Solution

Definition: $\frac{\Delta Q}{\Delta t} = k \frac{A\,(\Delta\theta)}{\Delta x}$

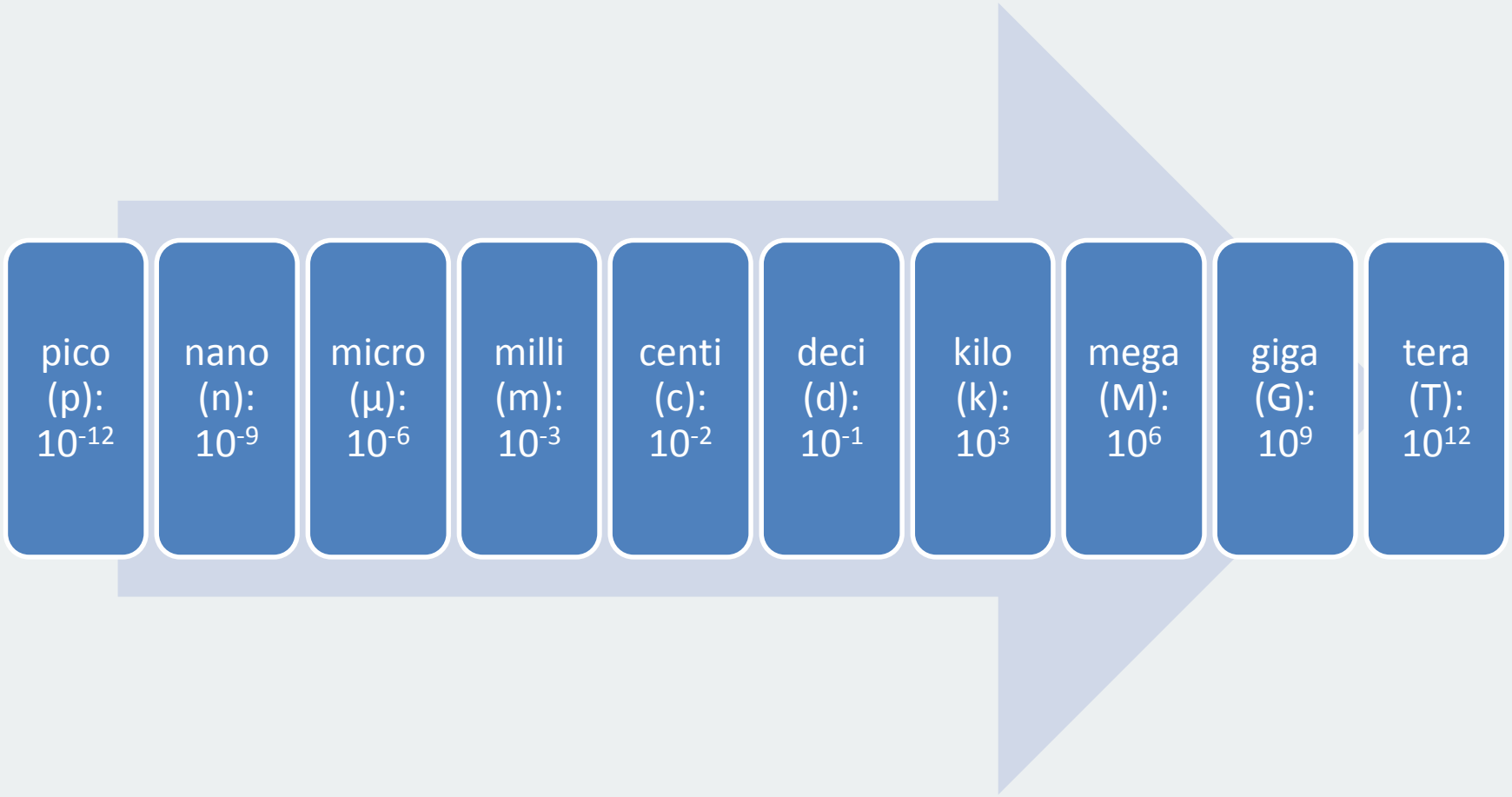
Hence thermal conductivity (k) = $\frac{\Delta Q/\Delta t}{A(\Delta\theta)/\Delta x}$

$\Delta Q/\Delta t$ has dimension similar with power = ML^2T^{-3}

A has dimension L^2 , and $\Delta\theta/\Delta x$ has dimension θ/L

Hence the dimension of thermal conductivity is $MLT^{-3}\theta^{-1}$ and SI unit for thermal conductivity is $Kg\ m\ s^{-3}k^{-1}$ or $W\ m^{-1}\ k^{-1}$

SI units


pico (p): 10^{-12}
nano (n): 10^{-9}
micro (μ): 10^{-6}
milli (m): 10^{-3}
centi (c): 10^{-2}
deci (d): 10^{-1}
kilo (k): 10^{3}
mega (M): 10^{6}
giga (G): 10^{9}
tera (T): 10^{12}

SI Units

- Precision: How **small** your **standart deviation** of the **result** taken from the measurement
- Accuracy: How **close** the mesurement **result** to the **actual** value

Error

Systematic Errors

- When **repeated measurements** with **uniform** condition are taken, **equal** value of magnitude and sign of **error** occur

Random Errors

- When **repeated measurements** with **uniform** condition are taken, **different** value of magnitudes and sign of **error** occur

Error

- Fractional Error $= \frac{\Delta R}{R}$

- Percentage Error $= \frac{\Delta R}{R}$ x 100%

Error with Example

Given: $A = 62.3 \pm 0.1$; $B = 32.2 \pm 0.2$

a) Addition

$R = A + B = 94.5 \pm \Delta R$; $\Delta R = \Delta A + \Delta B = 0.3$

b) Subtraction

$R = A - B = 30.1 \pm \Delta R$; $\Delta R = \Delta A + \Delta B = 0.3$

Error with Example

c) Product

R = A x B = 2006.06 ± ΔR; $\frac{\Delta R}{R} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

$\Delta R = (0.1/62.3 + 0.2/32.2)\ x\ 2006.06 = 15.68$

So R = 2006.06 ± 15.68

d) Quotient

R = $\frac{A}{B} = 1.93$ ± ΔR ; $\frac{\Delta R}{R} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$;

$\Delta R = (0.1/62.3 + 0.2/32.2)\ x\ 1.93 = 0.02$

So R = 1.93 ± 0.02

Scalar and Vector

Scalar: Physical quantity which **depends** only on **magnitude**

Vector: Physical quantity which **depends** on **magnitude** and **direction**

Scalar and Vector

Example:

Which pair contain 1 scalar and 1 vector quantity?

A. displacement and force

B. speed and mass

C. momentum and acceleration

D. kinetic energy and velocity

E. power and distance

Scalar and Vector

Solution:

A. Both quantities are vector

B. Both quantities are scalar

C. Both quantities are vector

D. Energy always scalar and velocity is vector

E. Both quantities are scalar

Ans: D

Example

Section A

1. Which of the experimental techniques below reduce the systematic error?

A. measuring several internodal distances on a standing wave to calculate the mean internodal distances

B. measure the diameter of a cylinder by doing measurement repeatedly and calculate the average

C. remove the zero error before measuring the current by adjusting the ammeter

D. plotting the graph of Voltage against Current from repeated measurements then calculate the gradient to determine the resistance

E. timing large number of oscillation to find period

Ans: C

Example

2. After a measurement is taken, current in a resistor is (2.5 ± 0.05) mA. The Resistor has a value (4.7Ω ± 2%). By calculating the value above, what is the percentage uncertainty of power dissipated in resistor?

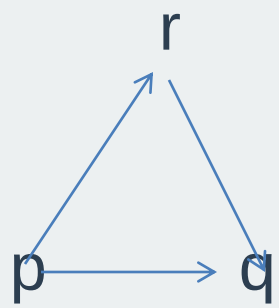
A. 5%
B. 6%
C. 7%
D. 8%
E. 12%

Ans: B

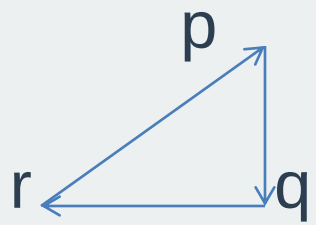
Example

3. Which of the vector below show an equilibrium

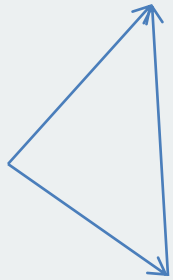
A.



B.



C.



D. none of the above

Ans: B

Example

Section B

1. Determine the dimension and unit (in term of base unit) of specific heat capacity, show your calculation! (**Ans**: $L^2 T^{-2} \theta^{-1}$; $m^2 s^{-2} k^{-1}$)
2. A cube has a length of each side is 30mm. The vernier callipers has an uncertainty of ±0.1 mm. Calculate the volume of the cube! (**Ans:** 27000 ± 270) mm^3)

Example

3. In an experiment, to determine the velocity of the ball when it almost hit the ground can be described by $v = \sqrt{2gh}$, where g is gravitatonal constant and h is the initial height when the ball was dropped. g is (9.8 ± 0.2) m/s^2 and h is (10.0 ± 0.5) m. Calculate v and its uncertainty

   Ans: (14.0 ± 2.0) m

Extra Tips

- Untuk mengetahui SI unit dengan mudah, kamu perlu mengetahui rumus-rumus dasar fisika.
- Seperti:
- Hukum Mekanika
- Hukum2 termodinamika
- Dan terutama hukum2 atau rumus2 yang menggunakan konstanta. Karena soal biasanya akan menanyakan SI unit dari konstanta tersebut

- Contoh, kita ambil dari contoh sebelumhya:
- Determine the dimension and SI unit of Thermal Conductivity
- Rumus-nya adalah:
- $\frac{\Delta Q}{\Delta t} = k \frac{A\,(\Delta T)}{\Delta x}$
- Ada satuan waktu: t -> second
- Ada satuan luas; A-> m^2
- Ada satuan temperatur: ΔT−>K
- Satuan panjang: Δx-> m
- Satuan kalor:?

- lupa satuan kalor? Kalor adalah bentuk dari energi. Yang satuannya sama dengan Usaha.
- Usaha= Gaya*Panjang
- Gaya=massa*akselerasi
- Kalor=Usaha=massa*akselerasi*panjang
- Kalor=kg m s^{-2} m=kg m^2 s^{-2}

- Masukan ke rumus

$$\frac{\Delta Q}{\Delta t} = k \frac{A\,(\Delta \mathrm{T})}{\Delta x}$$

Dan lakukan manipulasi aljabar untuk dapat satuan dari k(thermal conductivity)

References

A level complete guide, Themis Publisher,

www.xtremepapers.com,

Physics MCQ with helps (topical).