NOTE: reasonable estimates

- Mass of apple = 150 – 250 g
- Weight of apple = 1N
- Mass of car = 1000 – 2000 kg
- Mass of a raindrop = 10^{-5} kg
- Mass of a man = 70kg
- Running speed of a man = 5 m/s
- KE of a man running = ½ x 70 x 5^2 = 875 = 1000 approx
- Running speed of male Olympic runner = 10 m/s
- Running speed of female Olympic runner = 9 m/s
- KE of a olympian running = ½ x 70 x 11^2 = 4000 approx
- Frequency of a radio wave = 3 kHz – 300 GHz
- Mass of an atom = 10^{-27} kg
- Young's modulus of a metal (copper) = 10^{11} Pa
- Wavelength of violet: 380–450 nm
- Wavelength of blue: 450–495 nm
- Wavelength of green: 495–570 nm
- Wavelength of yellow: 570–590 nm
- Wavelength of orange: 590–620 nm
- Wavelength of red: 620–750 nm
- Atmospheric pressure at sea level = 10^5 Pa
- Distance between earth & sun = 1.5 x 10^{11} m
- Speed of light in vacuum = 2 x 10^8 m/s
- Speed of sound in air = 300 m/s
- Frequency of UV light = 7.5 × 10^{14} Hz to 3 × 10^{16} Hz
- Wavelength of UV light = 10 nm – 400 nm
- Lifespan of a man = 2 x 10^9 s
- Current in a fan heater = 12 A
- Water pressure at the bottom of a garden pond = 7500 Pa
- A4 sheet dimensions = 210 x 297 mm
- Thickness of sheet of paper = 0.05mm or 0.1mm
- Volume of exam paper = 6000mm3
- Speed of a container ship = 10 m/s
- Speed of a racing car = 90 m/s
- Speed of a snail = 1/360 m/s

1.

The radius of the Earth is approximately 6.4×10^6 m, and the radius of the Moon is approximately 1.7×10^6 m. A student wishes to build a scale model of the Solar System in the classroom, using a football of radius 0.12 m to represent the Earth.

Which object would best represent the Moon?

A basketball

B cherry

C golf ball

D tennis ball

Ans: D

Using ratio, radius of moon ball is approx 3cm, thus tennis ball

2.

Which quantity with its unit is correct?

A acceleration of a bicycle = $1.4\,\text{m s}^{-1}$

B electric current in a lamp = $0.25\,\text{A s}^{-1}$

C electric potential difference across a battery = $8.0\,\text{J C}^{-1}$

D kinetic energy of a car = $4500\,\text{N m}^{-1}$

Ans: C

E = VIt

V = E/It = E/((Q/I)t) = E/Q

3.

The luminosity L of a star is given by

$$L = 4\pi r^2 \sigma T^4$$

where

r is the radius of the star,

T is the temperature of the star and

σ is a constant with units $\text{W m}^{-2}\,\text{K}^{-4}$.

What are the SI base units of L?

A $\text{kg m}^2\,\text{s}^{-1}$ **B** $\text{kg m}^2\,\text{s}^{-2}$ **C** $\text{kg m}^2\,\text{s}^{-3}$ **D** $\text{kg m}^2\,\text{s}^{-4}$

Ans: C

$m^2 \times W_{2a^{-2}} \quad K^{+4} \times K^{+4}$

$W = \frac{J}{s} = \frac{kg \cdot m^2}{s^2 \cdot s} = kg\,m^2 s^{-3}$

4.

A man of mass 75.2 kg uses a set of weighing scales to measure his mass three times. He obtains the following readings.

	mass / kg
reading 1	80.2
reading 2	80.1
reading 3	80.2

Which statement describes the precision and accuracy of the weighing scales?

A not precise to ± 0.1 kg and accurate to ± 0.1 kg

B not precise to ± 0.1 kg and not accurate to ± 0.1 kg

C precise to ± 0.1 kg and accurate to ± 0.1 kg

D precise to ± 0.1 kg and not accurate to ± 0.1 kg

Ans: D

- Precise to = all of them measures up to 1dp.
- Accurate = all values would've been the same (80.2); since one value is different, it is not accurate.

5.

A digital meter has an accuracy of ±1%.

The meter is used to measure the current in an electrical circuit.

The reading on the meter varies between 3.04 A and 3.08 A.

What is the value of the current, with its uncertainty?

A (3.06 ± 0.02) A

B (3.06 ± 0.04) A

C (3.06 ± 0.05) A

D (3.06 ± 0.07) A

Ans: C

$I_{avg} = \frac{3.04 + 3.08}{2} = 3.06$

From meter:

$\frac{1}{100} \times 3.06 = \pm 0.0306$

$= \pm 0.03A$

From experimental:

$\frac{3.08 - 3.04}{2} = \pm 0.02A$

combine both uncertainties:

$0.03 + 0.02$

$= 0.05$

$\therefore (3.06 \pm 0.05)A$

6.

Which term represents a physical quantity?

A metre

B percentage uncertainty

C quark flavour

D spring constant

Ans: D

Spring constant has a value, as well as a unit (N m^{-1})

NOTE: Physical quantity = something that has a value AND a unit.

7.

A value for the acceleration of free fall on Earth is given as $(10 \pm 2)\,m\,s^{-2}$.

Which statement is correct?

A The value is accurate but not precise.

B The value is both precise and accurate.

C The value is neither precise nor accurate.

D The value is precise but not accurate.

Ans: A

- Accurate and precise value = 9.81
- 10 is close to 9.81, thus it is accurate.
- However 10 is not precise to 2 dp.

8.

A hollow cylinder, which is open at both ends, has a radius of (3.0 ± 0.1) cm and a length of (15.0 ± 0.1) cm.

What is the value, with its absolute uncertainty, of the surface area of the cylinder?

A $(280 \pm 10)\,cm^2$

B $(282.7 \pm 0.2)\,cm^2$

C $(420 \pm 30)\,cm^2$

D $(424.1 \pm 0.3)\,cm^2$

Ans: A

$SA = 2\pi rh$

% uncertainty in $r = \frac{0.1}{3} \times 100 = \frac{10}{3}$

% uncertainty in $h = \frac{0.1}{15} \times 100 = \frac{2}{3}$

total % uncertainty = 4%

$SA = 2\pi \times 3 \times 15$

$= 282.7 = 280$

absolute uncertainty =

$\frac{4}{100} \times 282.7 = 11.3$

given to 1 s.f = 10

280 ± 10

9.

What is the best estimate of the number of atoms in a piece of metal of volume $50\,cm^3$?

A 5×10^{15} **B** 5×10^{25} **C** 5×10^{29} **D** 5×10^{31}

Ans: B

- Diameter of atom = 10^{-10}m
- Volume of metal = 50 x $(10^{-2})^3$ = 5 x 10^{-5}
- No of atoms = (5 x 10^{-5}) / $(10^{-10})^3$ = 5 x 10^{25}

REMEMBER

Surface area of cylinder = $2\pi rh + 2\pi r^2$

Volume of cylinder = $\pi r^2 h$

10.

What is a reasonable estimate of the volume of one page from this examination paper?

A $60\,mm^3$ **B** $600\,mm^3$ **C** $6000\,mm^3$ **D** $60\,000\,mm^3$

Ans: C

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