1. Physical Quantities and Units

1.2 SI units

Paper 1

Question Paper

1 Which unit is an SI base unit?

A ampere

B coulomb

C degree Celsius

D gram

2 Which of the following could have the same units as force?

A $\frac{\text{energy}}{\text{distance}}$

B $\frac{\text{energy}}{\text{time}}$

C momentum × distance

D momentum × time

3 An aircraft flies from London to Sydney in a time of 21 hours 40 minutes.

The distance travelled is 17 000 km.

What is the average speed of the aircraft?

A $2.2\,\text{m}\,\text{s}^{-1}$

B $2.2 \times 10^{7}\,\mu\text{m}\,\text{s}^{-1}$

C $2.2 \times 10^{11}\,\text{nm}\,\text{s}^{-1}$

D $2.2 \times 10^{6}\,\text{mm}\,\text{s}^{-1}$

4 What are the SI base units for the moment of a force?

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

5 A physical quantity consists of a magnitude and a unit.

Which row does **not** show a correct combination of a quantity and its unit?

	quantity	unit
A	mass	gram
B	length	metre
C	charge	ampere
D	temperature	kelvin

6 Which unit is **not** an SI base unit?

A A **B** kg **C** C **D** s

7 Gm, Tm, μm and pm are all units of length.

Which unit is the largest and which unit is the smallest?

	largest unit	smallest unit
A	Gm	μm
B	Gm	pm
C	Tm	μm
D	Tm	pm

8 Which quantity is **not** an SI base quantity?

A charge

B mass

C temperature

D time

9 Which quantity is an SI base quantity?

A force

B newton

C second

D time

10 Which two units are identical when expressed in terms of SI base units?

A JC^{-1} and $kg\,m^2\,A^{-1}\,s^{-2}$

B Js and $kg\,m^2\,s^{-1}$

C Nm and $kg\,m^3\,s^{-2}$

D Ns and $kg\,m\,s^{-3}$

11 What is the symbol for the SI base unit of temperature?

A C **B** K **C** °C **D** °K

12 A voltmeter connected across a resistor in a circuit reads 3.6 V.

What could be the current in the resistor and the resistance of the resistor?

	current	resistance
A	150 mA	0.24 kΩ
B	15 mA	2.4 kΩ
C	1.5 mA	0.24 MΩ
D	15 μA	240 kΩ

13 What is a power of 3.7 MW when expressed in kilowatts?

A 3.7×10^{-3} kW

B 3.7×10^{-3} KW

C 3.7×10^{3} kW

D 3.7×10^{3} KW

14 Which combination of units could be used for expressing the power dissipated in a resistor?

A newton per second ($\mathrm{N\,s^{-1}}$)

B newton second (N s)

C newton metre (N m)

D newton metre per second ($\mathrm{N\,m\,s^{-1}}$)

15 Which quantity could have units of $\mathrm{N\,m\,V^{-1}}$?

A acceleration

B charge

C current

D resistance

16 The mobility μ of electrons travelling through a metal conductor can be calculated using the equation

$$\mu = \left(\frac{e}{m}\right)\tau$$

where e is the charge on an electron and m is its mass. The average time between the collisions of an electron with the atoms in the metal is τ.

What are the SI base units of μ?

A $\mathrm{A\,kg^{-1}}$ **B** $\mathrm{A\,s^{2}\,kg^{-1}}$ **C** $\mathrm{A\,s\,kg^{-1}}$ **D** $\mathrm{A\,s^{-2}\,kg^{-1}}$

17 What is an alternative way of expressing an energy of 43 dJ?

A 4.3×10^{3} mJ

B 4.3×10^{3} MJ

C 4.3×10^{-3} mJ

D 4.3×10^{-3} MJ

18 The frequency f of vibration of a mass m supported by a spring with spring constant k is given by the equation

$$f = Cm^{p}k^{q}$$

where C is a constant with no units.

What are the values of p and q?

	p	q
A	$-\frac{1}{2}$	$-\frac{1}{2}$
B	$-\frac{1}{2}$	$\frac{1}{2}$
C	$\frac{1}{2}$	$-\frac{1}{2}$
D	$\frac{1}{2}$	$\frac{1}{2}$

19 Which time interval is the shortest?

A 0.05 ms **B** 50 ns **C** 500 000 ps **D** 0.5 μs

20 The speed v of waves on a stretched wire is given by the equation

$$v = T^p \mu^q$$

where T is the tension in the wire and μ is the mass per unit length of the wire.

What are the values of p and q?

	p	q
A	$-\frac{1}{2}$	$-\frac{1}{2}$
B	$-\frac{1}{2}$	$\frac{1}{2}$
C	$\frac{1}{2}$	$-\frac{1}{2}$
D	$\frac{1}{2}$	$\frac{1}{2}$

21 Which unit can be expressed in base units as $\text{kg m}^2\text{ s}^{-2}$?

A joule

B newton

C pascal

D watt

22 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 $\mathrm{W\,m^{-2}\,K^{-4}}$.

What are the SI base units of L?

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

23 What is equivalent to 2000 microvolts?

A $2\,\mu\mathrm{J\,C^{-1}}$ **B** 2 mV **C** 2 pV **D** 2000 mV

24 The Planck constant h has SI units J s.

Which equation could be used to calculate the Planck constant?

A $h = \dfrac{DE}{v}$ where D is distance, E is energy and v is velocity

B $h = \dfrac{v}{D}$ where v is velocity and D is distance

C $h = \dfrac{1}{4\pi E}$ where E is electric field strength

D $h = \dfrac{Fr^2}{m}$ where F is force, r is radius and m is mass

25 The speed of a wave in deep water depends on its wavelength L and the acceleration of free fall g.

What is a possible equation for the speed v of the wave?

A $v = \sqrt{\left(\frac{gL}{2\pi}\right)}$ **B** $v = \frac{gL}{4\pi^2}$ **C** $v = 2\pi\sqrt{\left(\frac{g}{L}\right)}$ **D** $v = \frac{2\pi g}{L}$

26 Which expression gives an SI base quantity?

A charge per unit time

B force per unit area

C mass per unit volume

D work done per unit distance

27 A micrometer is used to measure the 28.50 mm width of a plastic ruler. The micrometer reads to the nearest 0.01 mm.

What is the correct way to record this reading?

A 0.02850 ± 0.01 m

B 0.0285 ± 0.001 m

C $(2.850 \pm 0.001) \times 10^{-2}$ m

D $(2.850 \pm 0.001) \times 10^{-3}$ m

28 A sheet of gold leaf has a thickness of 0.125 μm. A gold atom has a radius of 174 pm.

Approximately how many layers of atoms are there in the sheet?

A 4 **B** 7 **C** 400 **D** 700

29 The drag coefficient C_d is a number with no units. It is used to compare the drag on different cars at different speeds. C_d is given by the equation

$$C_d = \frac{2F}{v^n \rho A}$$

where F is the drag force on the car, ρ is the density of the air, A is the cross-sectional area of the car and v is the speed of the car.

What is the value of n?

A 1 **B** 2 **C** 3 **D** 4

30 When a beam of light is incident on a surface, it delivers energy to the surface. The intensity of the beam is defined as the energy delivered per unit area per unit time.

What is the unit of intensity, expressed in SI base units?

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

31 What is the unit of resistance when expressed in SI base units?

A $\text{kg m}^{2}\text{ s}^{-2}\text{ A}^{-1}$

B $\text{kg m}^{2}\text{ s}^{-3}\text{ A}^{-2}$

C $\text{kg m s}^{-2}\text{ A}^{-1}$

D $\text{kg m s}^{-3}\text{ A}^{-1}$