بسم الله الرحمن الرحيم

Physical Quantities & Units

Work Sheet 1.1

Question related to Base/Derived & Units

1 Which is an SI base unit?

A current

B gram

C kelvin

D volt

2 Which definition is correct and uses only quantities rather than units?

A Density is mass per cubic metre.

B Potential difference is energy per unit current.

C Pressure is force per unit area.

D Speed is distance travelled per second.

3 Which row shows an SI base quantity with its correct unit?

	SI base quantity	unit
A	charge	coulomb
B	current	ampere
C	potential difference	volt
D	temperature	degree Celsius

4 Which row shows a base quantity with its correct SI unit?

	quantity	unit
A	current	A
B	mass	g
C	temperature	°C
D	weight	N

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Question related to SI Base Units

5 What is the unit of weight in terms of SI base unit(s)?

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

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

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

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

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

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

7 What is the unit watt in terms of SI base units?

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

7 The SI unit for potential difference (the volt) is given, in base units, by

A $kg\,m\,A^{-1}\,s^{-3}$.

B $m^2\,A^{-1}\,s^{-2}$.

C $kg\,m^2\,s^{-2}$.

D $kg\,m^2\,A^{-1}\,s^{-3}$.

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Question related to Prefixes

8 Which list shows increasing lengths from beginning to end?

A 1 cm 1 nm mm μm

B 1 μm 1 mm nm cm

C 1 nm 1 μm mm cm

D 1 mm 1 cm μm nm

9 What is equivalent to 2000 microvolts?

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

10 A wave has a frequency of 5 GHz.

What is the period of the wave?

A 20 000 μs

B 20 ns

C 2 ns

D 200 ps

11 Which statement using prefixes of the base unit metre (m) is **not** correct?

A $1\ pm = 10^{-12}\ m$

B $1\ nm = 10^{-9}\ m$

C $1\ Mm = 10^{6}\ m$

D $1\ Gm = 10^{12}\ m$

13 What is the ratio $\frac{10^{-3}\ THz}{10^{3}\ kHz}$?

A 10^{-9} **B** 10^{-6} **C** 10^{0} **D** 10^{3}

14 Decimal sub-multiples and multipl es of units are indicated using a prefix to the unit. For example, the prefix milli (m) represents 10^{-3}.

Which row gives the sub-multiples or multiples represented by pico (p) and giga (G)?

	pico (p)	giga (G)
A	10^{-9}	10^{9}
B	10^{-9}	10^{12}
C	10^{-12}	10^{9}
D	10^{-12}	10^{12}

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15 Five energies are listed.

5 kJ

5 mJ

5 MJ

5 nJ

Starting with the smallest first, what is the order of increasing magnitude of these energies?

A 5 kJ → 5 mJ → 5 MJ → 5 nJ

B 5 nJ → 5 kJ → 5 MJ → 5 mJ

C 5 nJ → 5 mJ → 5 kJ → 5 MJ

D 5 mJ → 5 nJ → 5 kJ → 5 MJ

16 Which product-pair of metric prefixes has the greatest magnitude?

A pico × mega

B nano × kilo

C micro × giga

D milli × tera

17 The prefix 'centi' indicates x 10^{-2}.

Which line in the table correctly indicates the prefixes micro, nano and pico?

	x 10^{-12}	x 10^{-9}	x 10^{-6}
A	nano	micro	pico
B	nano	pico	micro
C	pico	nano	micro
D	pico	micro	nano

19 Which line of the table gives values that are equal to a time of 1 ps (one picosecond) and a distance of 1 Gm (one gigametre)?

	time of 1 ps	distance of 1 Gm
A	10^{-9} s	10^{9} m
B	10^{-9} s	10^{12} m
C	10^{-12} s	10^{9} m
D	10^{-12} s	10^{12} m

In these Questions you are supposed to compare SI Base Units

20 The equation relating pressure and density is $p = \rho gh$.

How can both sides of this equation be written in terms of base units?

A $[\mathrm{N\,m^{-1}}] = [\mathrm{kg\,m^{-3}}]\,[\mathrm{m\,s^{-1}}]\,[\mathrm{m}]$

B $[\mathrm{N\,m^{-2}}] = [\mathrm{kg\,m^{-3}}]\,[\mathrm{m\,s^{-2}}]\,[\mathrm{m}]$

C $[\mathrm{kg\,m^{-1}\,s^{-2}}] = [\mathrm{kg\,m^{-3}}]\,[\mathrm{m\,s^{-2}}]\,[\mathrm{m}]$

D $[\mathrm{kg\,m^{-1}\,s^{-1}}] = [\mathrm{kg\,m^{-1}}]\,[\mathrm{m\,s^{-2}}]\,[\mathrm{m}]$

21 The product of pressure and volume has the same SI base units as

A energy.

B force.

C $\frac{\text{force}}{\text{area}}$.

D $\frac{\text{force}}{\text{length}}$.

22 In the expressions below

a is acceleration,
F is force,
m is mass,
t is time,
v is velocity.

Which expression represents energy?

A Ft **B** Fvt **C** $\frac{2mv}{t}$ **D** $\frac{at^2}{2}$

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

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In these Questions you are supposed to find the SI base Units of unknown constats.

Tip: All equations given to you are homogenous & correct, plug in the units of known quantities and treat unknown constant as subject variable.

24 At temperatures close to 0 K, the specific heat capacity c of a particular solid is given by $c = bT^3$, where T is the thermodynamic temperature and b is a constant characteristic of the solid. The SI unit of specific heat capacity is $\mathrm{J\,kg^{-1}\,K^{-1}}$.

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

A $\mathrm{m^2\,s^{-2}\,K^{-3}}$

B $\mathrm{m^2\,s^{-2}\,K^{-4}}$

C $\mathrm{kg\,m^2\,s^{-2}\,K^{-3}}$

D $\mathrm{kg\,m^2\,s^{-2}\,K^{-4}}$

25 The time T taken for a satellite to orbit the Earth on a circular path is given by the equation

$$T^2 = \frac{kr^3}{M}$$

where r is the radius of the orbit, M is the mass of the Earth and k is a constant.

What are the SI base units of k?

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

26 The average kinetic energy E of a gas molecule is given by the equation

$$E = \tfrac{3}{2}kT$$

where T is the absolute (kelvin) temperature.

What are the SI base units of k?

A $\mathrm{kg^{-1}\,m^{-1}\,s^2\,K}$

B $\mathrm{kg^{-1}\,m^{-2}\,s^2\,K}$

C $\mathrm{kg\,m\,s^{-2}\,K^{-1}}$

D $\mathrm{kg\,m^2\,s^{-2}\,K^{-1}}$

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27 When the brakes are applied on a vehicle moving at speed v, the distance d moved by the vehicle in coming to rest is given by the expression

$$d = kv^2$$

where k is a constant.

What is the unit of k expressed in SI base units?

A $m^{-1}s^2$ **B** ms^{-2} **C** m^2s^{-2} **D** $m^{-1}s$

28 The spring constant k of a coiled wire spring is given by the equation

$$k = \frac{Gr^4}{4nR^3}$$

where r is the radius of the wire, n is the number of turns of wire and R is the radius of each of the turns of wire. The quantity G depends on the material from which the wire is made.

What is a suitable unit for G?

A Nm^{-2} **B** Nm^{-1} **C** Nm **D** Nm^2

29 One property Q of a material is used to describe the behaviour of sound waves in the material. Q is defined as the pressure P of the sound wave divided by the speed v of the wave and the surface area A of the material through which the wave travels:

$$Q = \frac{P}{vA}.$$

What are the SI base units of Q?

A kgm^2s^{-3} **B** $kgm^{-3}s^{-1}$ **C** $kgm^{-4}s^{-1}$ **D** $kgm^{-2}s^{-2}$

30 The frictional force F on a sphere falling through a fluid is given by the formula

$$F = 6\pi a\eta v$$

where a is the radius of the sphere, η is a constant relating to the fluid and v is the velocity of the sphere.

What are the units of η?

A $kgms^{-1}$ **B** $kgm^{-1}s^{-1}$ **C** $kgms^{-3}$ **D** kgm^3s^{-3}

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In these Questions you are supposed to find out the unknown power.

Tip: All the equation are homogenuos, plug in the SI base Units, simplify and compare the indices. (as we learned "Deriving a Physical Equation")

31 The speed v of a liquid leaving a tube depends on the change in pressure ΔP and the density ρ of the liquid. The speed is given by the equation

$$v = k\left(\frac{\Delta P}{\rho}\right)^n$$

where k is a constant that has no units.

What is the value of n?

A $\frac{1}{2}$ **B** 1 **C** $\frac{3}{2}$ **D** 2

32 The maximum theoretical power P of a wind turbine is given by the equation

$$P = k\rho A v^n$$

where ρ is the density of air, A is the area swept by the turbine blades, v is the speed of the air and k is a constant with no units.

What is the value of n?

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

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

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

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

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