Physical Quantities & Units

TOPIC QUESTIONS (1)

Level	A Level
Subject	Physics
Exam Board	CIE
Paper Type	Multiple Choice

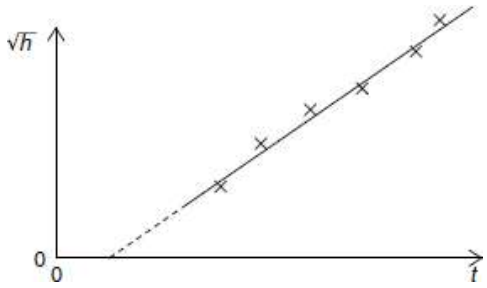
Time Allowed : 1 HOUR

1.Which of the following pairs of units are both SI base units?
A ampere, degree Celsius **B** ampere, kelvin
C coulomb, degree Celsius **D** coulomb, Kelvin

2.Which formula could be correct for the speed *v* of oceanwaves in terms of the density ρ□of seawater, the acceleration of free fall *g*, the depth *h* of the ocean and thewavelength λ?

A $v = \sqrt{g\lambda}$ B $v = \sqrt{\frac{g}{h}}$ C $v = \sqrt{\rho g h}$ D $v = \sqrt{\frac{g}{\rho}}$

3.A student measures the time *t* for a ball to fall from restthrough a vertical distance *h*. Knowing that the equation $h = \frac{1}{2} gt^2$ applies, the student plots the graphshown.



Which of the following is an explanation for the intercept on the *t* axis?
A Air resistance has not been taken into account for largervalues of *h*.
B There is a constant delay between starting the timer andreleasing the ball.
C There is an error in the timer that consistently makes it runfast.
D The student should have plotted *h* against *t* 2.

4.The power loss *P* in a resistor is calculated using the formula $P = V^2/R$. The uncertainty in the potential difference *V* is 3% andthe uncertainty in the resistance *R* is 2%.
What is the uncertainty in *P*?
A 4% **B** 7% **C** 8% **D** 11%

5.The prefix 'centi' indicates x 10^{-2}. That is, 1 centimetre isequal to 1 x 10^{-2} metre.
Which line in the table correctly indicates the prefixes micro, nano and pico?

	$\times 10^{-12}$	$\times 10^{-9}$	$\times 10^{-6}$
A	nano	micro	pico
B	micro	pico	nano
C	pico	nano	micro
D	pico	micro	nano

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

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

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

C $1\,\text{Mm} = 6\,\text{m}$

D $1\,\text{Gm} = 12\,\text{m}$

7.Which group of quantities contains only vectors?

A acceleration, displacement, speed

B acceleration, work, electric field strength

C displacement, force, velocity

D power, electric field strength, force

8.Which quantity can be measured in electronvolts (eV)?

A electric charge

B electric potential

C energy

D power

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

A 10^{-9} B 10^{-6} C 10^{0} D 1

10.The following physical quantities can be either positive or negative.

s : displacement of a particle along a straight line

θ : temperature on the Celsius scale

q : electric charge

V : readings on a digital

voltmeterWhich of these

quantities are vectors?

A *s*, θ, *q*, *V* B *s*, *q*, *V* only C θ, *V* only D *s* only

11.The average kinetic energy *E* of a gas molecule is given by the equation

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

where *T* is the absolute (kelvin) temperature.

What are the S*I* base units of *k*?

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

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

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

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

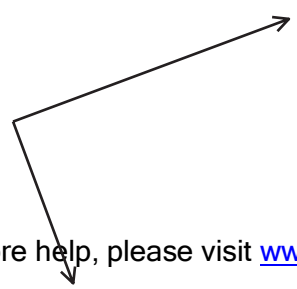
12.The arrow represents the vector R.

Which diagram does not represent R as two perpendicular components?

A

B

C



D

13. Which statement includes a correct unit?

A energy = 7.8 N s

B force = 3.8 N s

C momentum = 6.2 N s

D torque = 4.7 N s

14. What is the joule (J) in S*I* base units?

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

15. The speed of an aeroplane in still air is 200 $km\,h^{-1}$. The wind blows from the west at a speed of 85.0 $km\,h^{-1}$.

In which direction must the pilot steer the aeroplane in order to fly due north?

A 23.0° east of north

B 23.0° west of north

C 25.2° east of north

D 25.2° west of north

16. Which of the following is a scalar quantity?

A acceleration **B** mass
C momentum **D** velocity

17. The unit of work, the joule, may be defined as the work done when the point of application of a force of 1 newton is moved a distance of 1 metre in the direction of the force.
Express the joule in terms of the base units of mass, length and time, the kg, m and s.

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

18. Which experimental technique reduces the systematic error of the quantity being investigated?

A adjusting an ammeter to remove its zero error before measuring a current

B measuring several internodal distances on a standing wave to find the mean internodal distance

C measuring the diameter of a wire repeatedly and calculating the average

D timing a large number of oscillations to find a period

19. A student makes measurements from which she calculates the speed of sound as 327.66 ms^{-1}.
She estimates that her result is accurate to ±3 %.
Which of the following gives her result expressed to the appropriate number of significant figures?

A 327.7 ms^{-1} **B** 328 ms^{-1} **C** 330 ms^{-1} **D** 300 ms^{-1}

20. A steel rule can be read to the nearest millimetre. It is used to measure the length of a bar whose true length is 895 mm. Repeated measurements give the following readings.

length / mm	892, 891, 892, 891, 891, 892

Are the readings accurate and precise to within 1mm?

	results are accurate to within 1 mm	results are precise to within 1 mm
A	no	no
B	no	yes
C	yes	no
D	yes	yes

21. What is equivalent to the unit of electric field strength?

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

22. 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 S*I* base units?

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

23. Which list contains one vector quantity and two scalar quantities?

A displacement, weight, velocity

B force, acceleration, time

C momentum, mass, speed

D work, density, energy

24. Which pair of units contains one derived unit and one S*I* base unit?

A ampere coulomb

B kilogram kelvin

C metre second

D newton pascal

25. What is equivalent to 2000 microvolts?

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

26. 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

27. 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

28. What is the unit of resistance when expressed in S*I* 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 $kg\,m\,s^{-3}\,A^{-1}$

29. Which quantity can be measured in electronvolts (eV)?

A electric charge

B electric potential

C energy

D power

30. The unit of specific heat capacity is J kg^{-1} K^{-1}.

What is its equivalent in terms of S*I* base units?

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

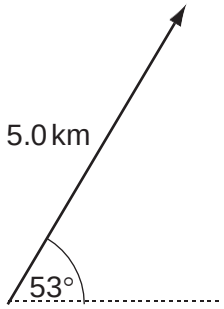
31. The unit of resistivity, expressed in terms of base units, is given by

$$kg\,x^3\,y^{-2}\,z^{-3}.$$

Which base units are x, y and z?

	x	y	z
A	ampere	metre	second
B	metre	ampere	second
C	metre	second	ampere
D	second	ampere	metre

32. The diagram shows a displacement vector.



What is the vertical component of this displacement vector?

A 3.0 km B 4.0 km C 5.0 km D 6.6 km

33. What is the unit of power, expressed in S*I* base units?

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

34. Which statement is incorrect by a factor of 100 or more?

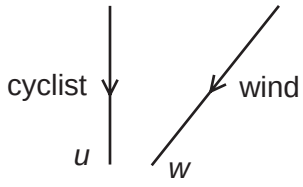
A Atmospheric pressure is about 1×10^5 Pa.

B Light takes 5×10^2 s to reach us from the Sun.

C The frequency of ultra-violet light is 3×10^{12} Hz.

D The life-span of a man is about 2×10^9 s.

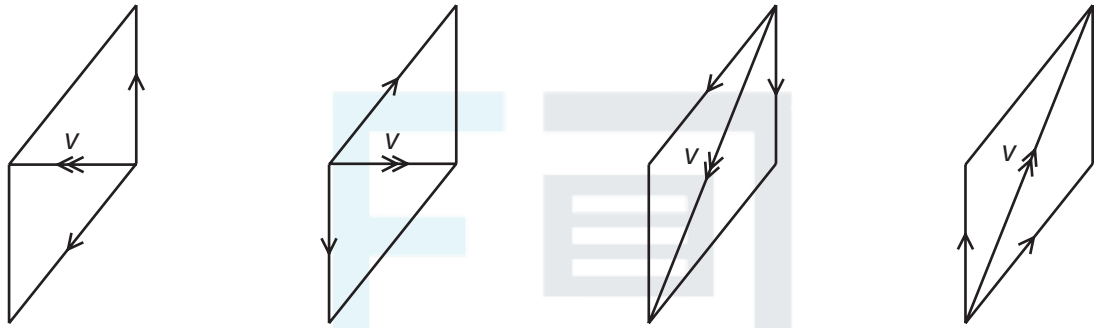
35. A cyclist is travelling due south with velocity u. The wind is blowing from the north-east with velocity w.



The wind has a velocity v relative to the cyclist, where $v = w - u$.

Which vector diagram shows the magnitude and direction of velocity v?

A **B**



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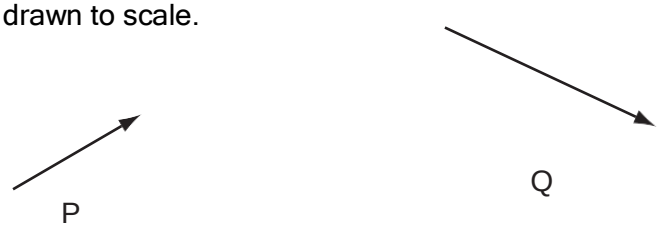
36. What is the unit of weight in terms of S*I* base unit(s)?

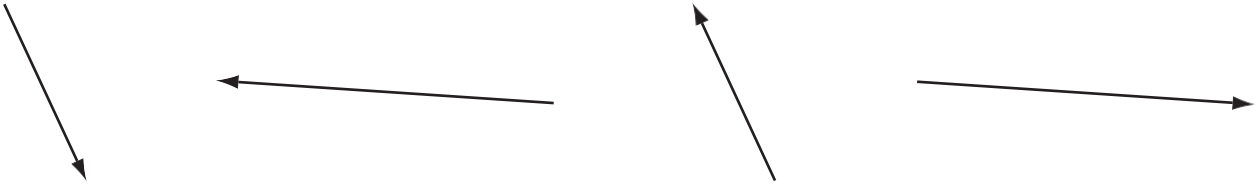
A $kg\,m\,s^{-1}$ B $kg\,m\,s^{-2}$ C N D $J\,m^{-1}$

37. Vectors P and Q are drawn to scale.



Which diagram represents the vector (P - Q)?

A **B** **C** **D**



38. Which list contains only scalar quantities?

A area, length, displacement

B kinetic energy, speed, power

C potential energy, momentum, time

D velocity, distance, temperature

39. Which quantity has the same base units as momentum?

A density × energy

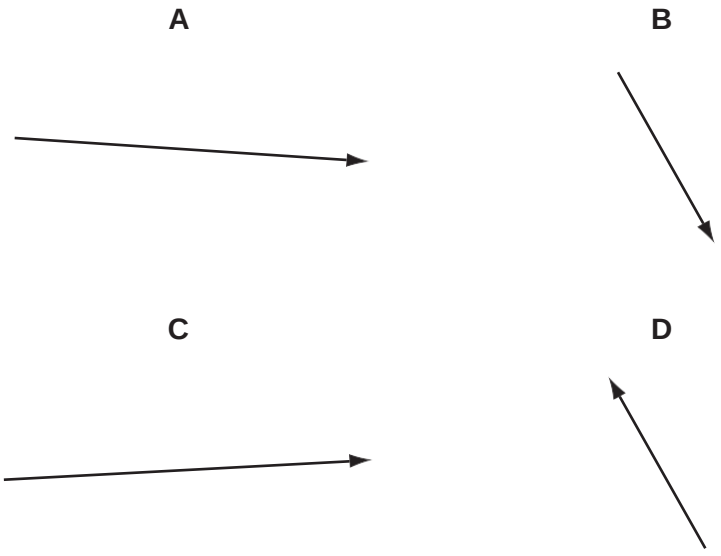
B density × volume × velocity

C pressure × area

D weight ÷ area

40. Vectors P and Q are drawn to scale.

Which diagram represents the vector (P + Q)?



41. Which of the following definitions 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.

42. 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 kg m^{-2} s^{-1} B kg m^2 s^{-3} C kg s^{-2} D kg s^{-3}

43. Four students each made a series of measurements of the acceleration of free fall g. The table shows the results obtained. Which student obtained a set of results that could be described as precise but not accurate?

student	results, g / m s^{-2}			
A	9.81	9.79	9.84	9.83
B	9.81	10.12	9.89	8.94
C	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

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

45. A metal sphere of radius r is dropped into a tank of water. As it sinks at speed v, it experiences a drag force F given by F = kr v, where k is a constant.
What are the SI base units of k?
A kg m^2s^{-1} B kg $m^{-2}s^{-2}$ C kg $m^{-1}s^{-1}$ D kg m s^{-2}

46. An Olympic athlete of mass 80 kg competes in a 100 m race. What is the best estimate of his mean kinetic energy during the race?

A 4×10^2 J B 4×10^3 J C 4×10^4 J D 4×10^5 J

47. In an experiment, a radio-controlled car takes 2.50 ± 0.05 s to travel 40.0 ± 0.1 m.
What is the car's average speed and the uncertainty in this value?
A 16 ± 1 m s^{-1} B 16.0 ± 0.2 m s^{-1}
C 16.0 ± 0.4 m s^{-1} D 16.00 ± 0.36 m s^{-1}

48. Which pair of units are both SI base units?

A ampere, degree celsius B ampere, kelvin
C coulomb, degree Celsius D coulomb, Kelvin

49. A student measures a current as 0.5 A.
Which of the following correctly expresses this result?

A 50 mA **B** 50 MA **C** 500 mA **D** 500MA

50. The momentum of an object of mass m is p. Which quantity has the same base units as ?

$$\frac{p^2}{m}$$

A energy **B** force **C** power **D** velocity