Practice Test – Chapter 1

1.

What is the ratio $\frac{1\mu m}{1Gm}$?

A 10^{-3} **B** 10^{-9} **C** 10^{-12} **D** 10^{-15}

2.

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

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

3.

Which formula could be correct for the speed v of ocean waves in terms of the density ρ of sea-water, the acceleration of free fall g, the depth h of the ocean and the wavelength λ?

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

4.

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

5.

Which pair of units contains one derived unit and one SI base unit?

A ampere coulomb

B kilogram kelvin

C metre second

D newton pascal

6.

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** $J\,m^{-1}$

7.

What is equivalent to 2000 microvolts?

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

8.

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

9.

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

10.

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

11.

A signal has a frequency of 2.0 MHz.

What is the period of the signal?

A 2 μs **B** 5 μs **C** 200 ns **D** 500 ns

HINT: Period = 1 / Frequency

12.

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

13.

When a constant braking force is applied to 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.

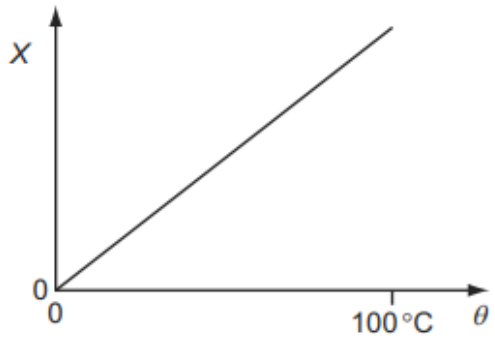
When d is measured in metres and v is measured in metres per second, the constant has a value of k_1.

What is the value of the constant when the distance is measured in metres, and the speed is measured in kilometres per hour?

A $0.0772\,k_1$ **B** $0.278\,k_1$ **C** $3.60\,k_1$ **D** $13.0\,k_1$

14.

A quantity X varies with temperature θ as shown.



θ is determined from the corresponding values of X by using this graph.
X is measured with a percentage uncertainty of ±1 % of its value at all temperatures.

Which statement about the uncertainty in θ is correct?

A The percentage uncertainty in θ is least near 0 °C.

B The percentage uncertainty in θ is least near 100 °C.

C The actual uncertainty in θ is least near 0 °C.

D The actual uncertainty in θ is least near 100 °C.

15.

A micrometer is used to measure the diameters of two cylinders.

diameter of first cylinder = 12.78 ± 0.02 mm

diameter of second cylinder = 16.24 ± 0.03 mm

The difference in the diameters is calculated.

What is the uncertainty in this difference?

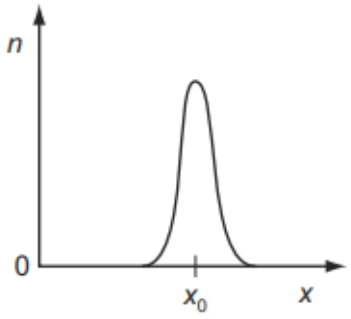
A ±0.01 mm **B** ±0.02 mm **C** ±0.03 mm **D** ±0.05 mm

16.

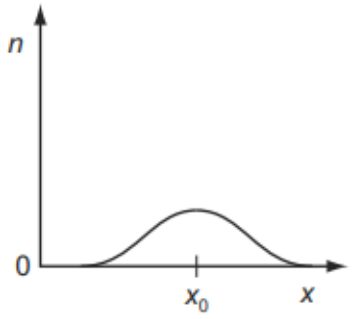
A fixed quantity x_0 is measured many times in an experiment that has experimental uncertainty. A graph is plotted to show the number n of times that a particular value x is obtained.

Which graph could be obtained if the measurement of x_0 has a large systematic error but a small random error?

A



B



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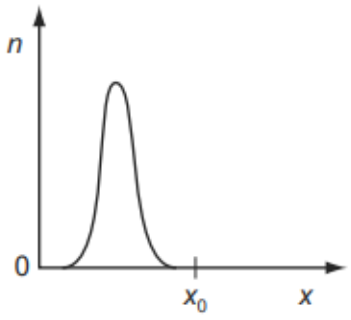

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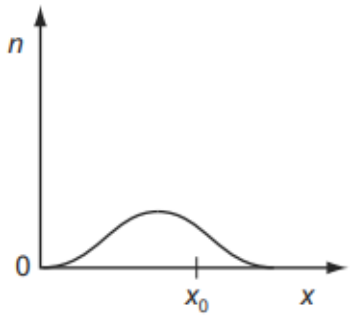
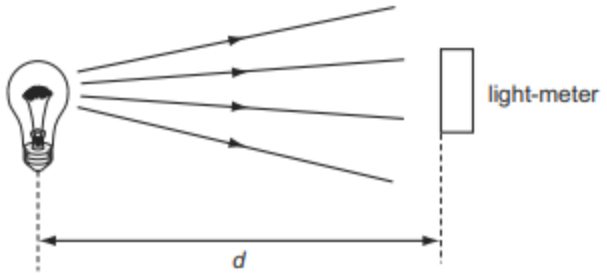
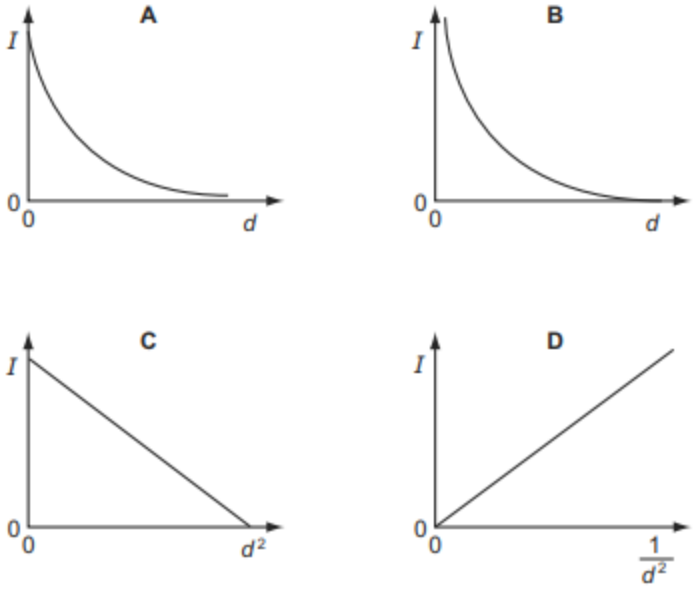


17.

A light-meter measures the intensity I of the light falling on it. Theory suggests that I varies inversely as the square of the distance d.



Which graph of the results supports this theory?



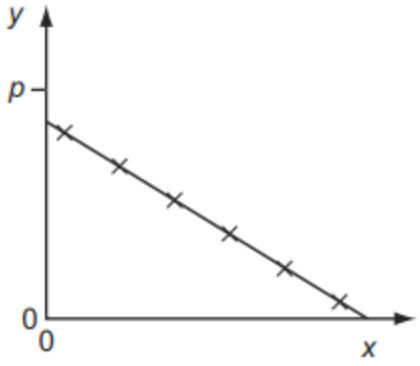
18.

Variables x and y are related by the equation $y = p - qx$ where p and q are constants.

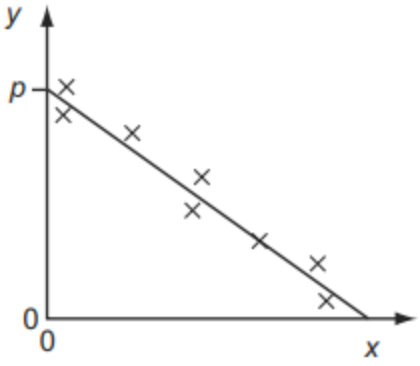
Values of x and y are measured experimentally. The results contain a systematic error.

Which graph best represents these results?

A



B



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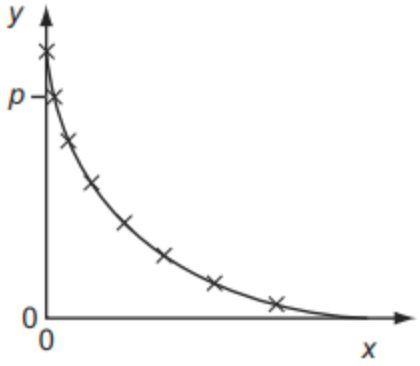

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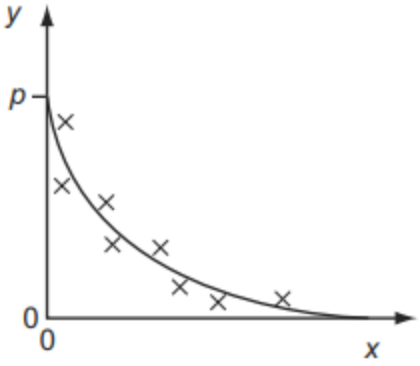


19.

The measurement of a physical quantity may be subject to random errors and to systematic errors.

Which statement is correct?

A Random errors can be reduced by taking the average of several measurements.

B Random errors are always caused by the person taking the measurement.

C A systematic error cannot be reduced by adjusting the apparatus.

D A systematic error results in a different reading each time the measurement is taken.

20.

A micrometer screw gauge is used to measure the diameter of a small uniform steel sphere. The micrometer reading is 5.00 mm ± 0.01 mm.

What will be the percentage uncertainty in a calculation of the volume of the sphere, using these values?

A 0.2% **B** 0.4% **C** 0.6% **D** 1.2%

21.

A quantity y is to be determined from the equation shown.

$$y = \frac{px}{q^2}$$

The percentage uncertainties in p, x and q are shown.

	percentage uncertainty
p	6%
x	2%
q	4%

What is the percentage uncertainty in y?

A 0.5% **B** 1% **C** 16% **D** 192%

22.

A thermometer can be read to an accuracy of ±0.5 °C. This thermometer is used to measure a temperature rise from 40 °C to 100 °C.

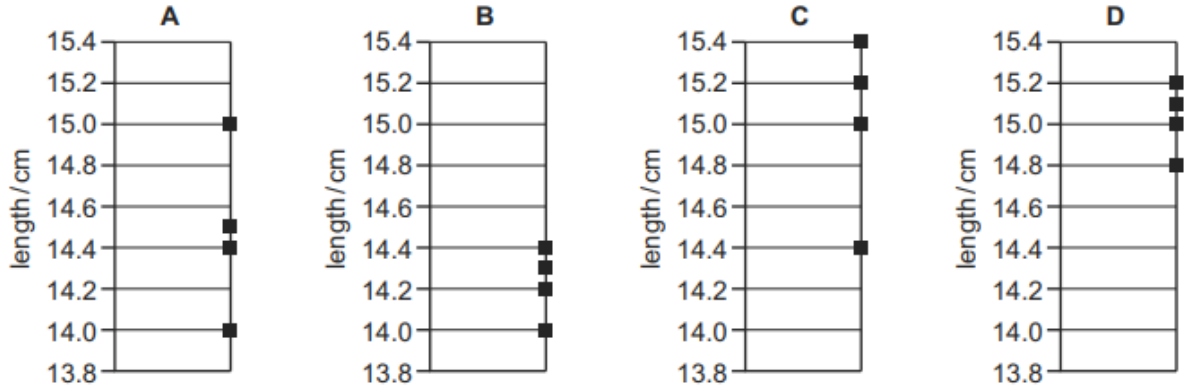
What is the percentage uncertainty in the measurement of the temperature rise?

A 0.5% **B** 0.8% **C** 1.3% **D** 1.7%

23.

Four different students use a ruler to measure the length of a 15.0 cm pencil. Their measurements are recorded on four different charts.

Which chart shows measurements that are precise but **not** accurate?



24.

In an experiment to determine the acceleration of free fall g, a ball bearing is held by an electromagnet. When the current to the electromagnet is switched off, a clock starts and the ball bearing falls. After falling a distance h, the ball bearing strikes a switch to stop the clock which measures the time t of the fall.

If systematic errors cause t and h to be measured incorrectly, which error **must** cause g to appear greater than $9.81\,m\,s^{-2}$?

A h measured as being **smaller** than it actually is and t is measured correctly

B h measured as being **smaller** than it actually is and t measured as being **larger** than it actually is

C h measured as being **larger** than it actually is and t measured as being **larger** than it actually is

D h is measured correctly and t measured as being **smaller** than it actually is

25.

The strain energy W of a spring is determined from its spring constant k and extension x. The spring obeys Hooke's law and the value of W is calculated using the equation shown.

$$W = \frac{1}{2}kx^2$$

The spring constant is $100 \pm 2\,\text{N m}^{-1}$ and the extension is $0.050 \pm 0.002\,\text{m}$.

What is the percentage uncertainty in the calculated value of W?

A 6% **B** 10% **C** 16% **D** 32%

Answer Key:

1. D	6. B	11. D	16. C	21. C
2. D	7. B	12. D	17. D	22. D
3. A	8. A	13. A	18. A	23. B
4. A	9. B	14. C	19. A	24. D
5. A	10. C	15. D	20. C	25. B