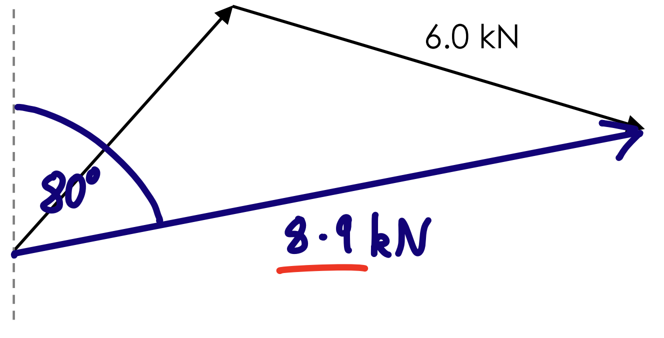
1st August

1 2 3

1. Calculate the **area**, in m², of a circle with a radius of:
   a. 2.0 m $A = \pi r^2 = 13\ m^2$
   b. 4.0 m " $= 50\ m^2$
   c. 4.0 cm " $= \pi \times (4.0\times10^{-2})^2 = 5.0\times10^{-3}\ m^2$
   d. 4.0 mm " $= \pi \times (4.0\times10^{-3})^2 = 5.0\times10^{-5}\ m^2$

2. Complete the tip-to-tail vector diagram by drawing in the resultant vector, working out its **magnitude** and measuring the **angle** from the vertical.



3. Write down the seven **base units** that all other derived units can be expressed in.

- kg kilogram
- m metre
- s second
- A ampere
- K kelvin
- mol mole
- cd candela

2nd August

1 2 3

1. Calculate the **area**, in m^2, of a circle with:
   a. Radius 5.0 mm
   b. Diameter 5.0 mm
   c. Diameter 10.0 mm
   d. Circumference 10.0 mm

$A = \pi r^2 = 7.9 \times 10^{-5}\ m^2$

$A = \frac{\pi d^2}{4} = 2.0 \times 10^{-5}\ m^2$

$= 7.9 \times 10^{-5}\ m^2$

$c = \pi d \quad \therefore \quad A = \frac{c^2}{4\pi} = 8.0 \times 10^{-6}\ m^2$

2. Find out what the following **symbols** in A Level Physics represent:
   a. G — Gravitational constant
   b. ε_0 — Permittivity of free space
   c. pc — Parsec
   d. h — Planck's constant
   e. eV — Electronvolt
   f. m_e — Mass of an electron

3. Show that the base units for **joules** are kg m^2 s^{-2}.

$E_K = \frac{1}{2} m v^2$

$J = kg \times (m\,s^{-1})^2$

$J = kg \times m^2 s^{-2}$

$J = kg\, m^2 s^{-2}$

3rd August

1 2 3

1. Calculate the **area**, in m^2, of a triangle with a:
   a. Vertical height of 36 cm and a base of 11 cm
   b. Vertical height of 18 cm and a base of 36 cm
   c. Vertical height of 36.2 cm and a base of 1.13 m

$A = \frac{1}{2} \times \text{base} \times \text{height}$

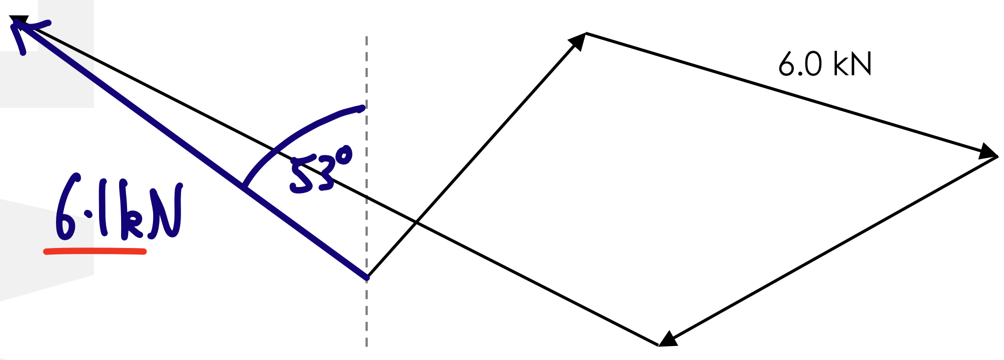
$A = 0.5 \times 11 \times 36 = 0.020\ m^2$

$A = 0.5 \times 36 \times 18 = 0.032\ m^2$

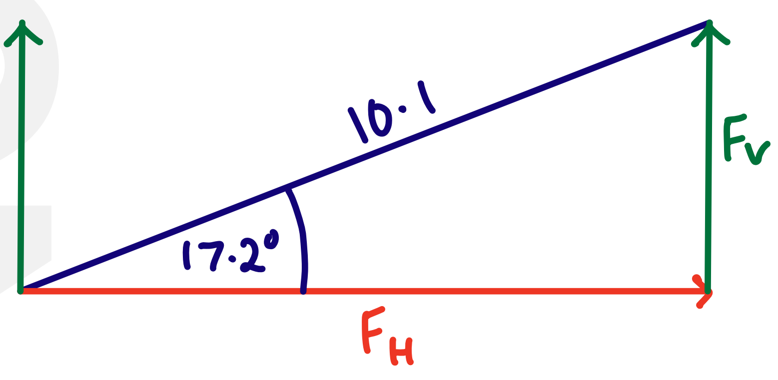
$A = 0.5 \times 1.13 \times 0.362$

$A = 0.020453 \approx 0.0205\ m^2$

2. Complete the tip-to-tail vector diagram by drawing in the resultant vector, working out its **magnitude** and measuring the **angle** from the vertical.



3. Calculate the **horizontal** and **vertical** components of a 10.1 N force acting at 17.2° above the horizontal.



$F_V = 10.1 \sin 17.2$

$F_V = 2.99\ N$

$F_H = 10.1 \cos 17.2 = 9.65\ N$

4th August

1 2 3

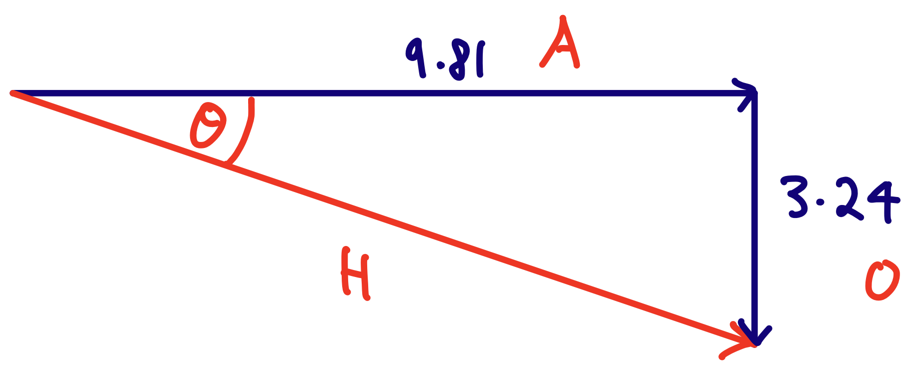
1. Calculate the **surface area**, in m^2, of a sphere with a radius of:
    a. 0.80 m $A = 4\pi r^2 = 8.0\,m^2$
    b. 0.40 m " $= 2.0\,m^2$
    c. 0.20 m " $= 0.50\,m^2$
    d. 0.10 m " $= 0.13\,m^2$

Notice a pattern?

2. Find out the values for the following **constants** used regularly throughout A Level Physics:
    a. Mass of an electron 9.11×10^{-31} kg
    b. Planck's constant 6.63×10^{-34} Js
    c. Speed of light $3.00 \times 10^{8}\,m s^{-1}$
    d. Elementary charge 1.60×10^{-19} C
    e. Gravitational field strength on Earth's surface $9.81\,N kg^{-1}$
    f. Acceleration due to gravity on Earth $9.81\,m s^{-2}$

These will all be found in your data book.

3. Calculate the **direction** of the resultant force when 9.81 N acts to the right and 3.24 N acts downwards.



$$\theta = \tan^{-1}\left(\frac{O}{A}\right) = \tan^{-1}\left(\frac{3.24}{9.81}\right) = 18.3^\circ$$

18.3° below the horizontal

5th August

1 2 3

1. Calculate the **volume**, in m³, of a sphere with a radius of:
   a. 0.80 m
   b. 0.40 m
   c. 0.20 m
   d. 0.10 m

$V = \frac{4}{3}\pi r^3 = 2.1\ m^3$

$'' = 0.27\ m^3$

$'' = 0.034\ m^3$

$'' = 0.0042\ m^3$

Notice a pattern?

2. Write down the **proportionality relationship** between gravitational potential energy and mass (for a uniform field).

$E_p = mgh$

$E_p \propto m$

E_p or PE often used

3. Calculate the **combined** resistance of a 30 Ω and 50 Ω resistor connected in parallel.

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_T} = \frac{1}{30} + \frac{1}{50}$

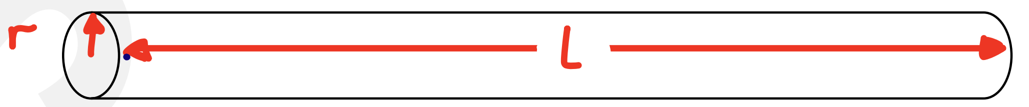
$\frac{1}{R_T} = 0.05333$

$R_T = 18.75 = \underline{19}\ \Omega$

6th August

1 2 3

1. Calculate the **volume** and **surface area** of a cylinder with a radius of 92 mm and a length of 2.7 m.

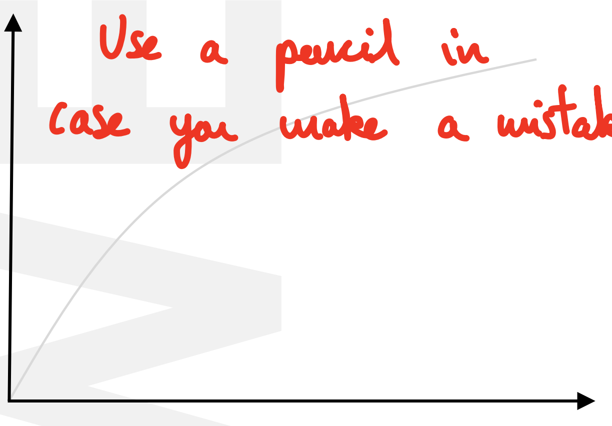


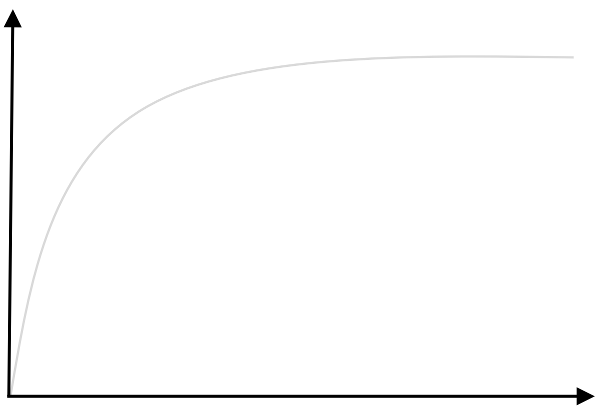
$$V = \pi r^2 L = \pi \times (92 \times 10^{-3})^2 \times 2.7 = \underline{0.072}\ m^3$$

$$A = 2 \times (\pi r^2) + 2\pi r L = \underline{1.6}\ m^2$$

2. Trace the following **curves**.

Use a pencil in case you make a mistake!





3. A catapult launches a stone vertically at 25 m s^{-1}. By equating kinetic energy and gravitational potential energy, calculate the **maximum height** reached.

   Assume there are no energy losses and there is negligible air resistance.

$$E_k = E_p$$

$$\frac{1}{2} \cancel{m} v^2 = \cancel{m} g \Delta h$$

$$\Delta h = \frac{v^2}{2g} = \frac{25^2}{2 \times 9.81} = \underline{32}\ m$$

7th August

1 2 3

1. Calculate the **volume**, in m^3, and **surface area**, in m^2, of a sphere with a radius of:
   a. 82 mm
   b. 6.4 cm
   c. 6400 km ← Earth
   d. 6.96 x 10^5 km ↑ Our Sun

$V = \frac{4}{3}\pi r^3$ $\quad$ $A = 4\pi r^2$

$V = 2.3 \times 10^{-3}\ m^3$ $\quad$ $A = 8.4 \times 10^{-2}\ m^2$

$V = 1.1 \times 10^{-3}\ m^3$ $\quad$ $A = 5.1 \times 10^{-2}\ m^2$

$V = 1.1 \times 10^{21}\ m^3$ $\quad$ $A = 5.1 \times 10^{14}\ m^2$

$V = 1.41 \times 10^{27}\ m^3$ $\quad$ $A = 6.09 \times 10^{18}\ m^2$

2. Rearrange the following to make **T** the subject:
   a. $f = 1 / T$ $\quad$ $T = 1/f$
   b. $W = T\theta$ $\quad$ $T = W/\theta$
   c. $pV = nRT$ $\quad$ $T = pV/nR$
   d. $P = \sigma AT^4$ $\quad$ $T = \sqrt[4]{\frac{P}{\sigma A}}$

3. Calculate the **speed** of a wave that has a time period of 4.0 s and a wavelength of 40 m.

$v = f\lambda$ $\quad$ $f = \frac{1}{T}$

$v = \frac{\lambda}{T}$

$v = \frac{40}{4.0} = \underline{10}\ ms^{-1}$

8th August

1 2 3

1. Calculate the **diameter**, in m, of a wire with a cross-sectional area of:

   a. 1.0 m^2

   b. 0.16 m^2

   c. 100 mm^2

   d. 1.7 x 10^{-3} m^2

$d = \sqrt{\frac{4A}{\pi}}$

$d = 1.1 m$

$d = 0.45 m$

$d = 0.011 m$

$d = 0.047 m$

$A = \frac{\pi d^2}{4}$

$\frac{4A}{\pi} = d^2$

$d = \sqrt{\frac{4A}{\pi}}$

$(1 mm^2 = 1 \times 10^{-6} m^2)$

2. Rearrange the following to make **ω** the subject:

   a. $P = T\omega$ $\qquad \omega = P/T$

   b. $v_{max} = \omega a$ $\qquad \omega = v_{max}/a$

   c. $F = m\omega^2 r$ $\qquad \omega = \sqrt{\frac{F}{mr}}$

   d. $E_k = ½I\omega^2$ $\qquad \omega = \sqrt{\frac{2E_k}{I}}$

3. A radioactive sample has an initial activity of 2 000 Bq.

   Calculate the **activity** of the sample after 4 half-lives.

0	2000
1	1000
2	500
3	250
4	125

or $\frac{2000}{2^4} = 125 Bq$

9th August

1 2 3

1. Calculate the **volume**, in m³, of a cylinder with a :
   a. Radius of 920 mm and a height of 2.7 m
   b. Length of 20 m and diameter 1.9 mm
   c. Length 2.1 m and radius 0.89 mm

$V = \pi r^2 h = 7.2\ m^3$

$V = \frac{\pi d^2}{4} L = 5.7 \times 10^{-5}\ m^3$

$V = \pi r^2 L = 5.2 \times 10^{-6}\ m^3$

2. Rearrange the following to make **V** the subject:
   a. $\rho = m / V$ $\quad V = m/\rho$
   b. $R = V / I$ $\quad V = IR$
   c. $pV = NkT$ $\quad V = NkT/p$
   d. $P = V^2 / R$ $\quad V = \sqrt{PR}$

3. 0.050 m³ of a gas is at a pressure of 220 kPa. The volume is decreased to 0.010 m³.

   Calculate the **pressure** of the gas after it has been compressed, provided the temperature has remained constant.

$p_1 V_1 = p_2 V_2$

$p_2 = p_1 \frac{V_1}{V_2} = 220 \times \frac{0.050}{0.010} = 1100\ kPa$

ANSWERS

10th August

1 2 3

1. Calculate the gradient and hence the **equation** of the straight-line graph that goes through the points (0, 2) and (5, 7).

$$m = \frac{\Delta y}{\Delta x} = \frac{7-2}{5-0} = 1$$

$$y - 2 = 1(x - 0)$$

$$y = x + 2$$

2. Rearrange the following to make **v** the subject:

   a. $P = Fv$ $\quad v = P/F$

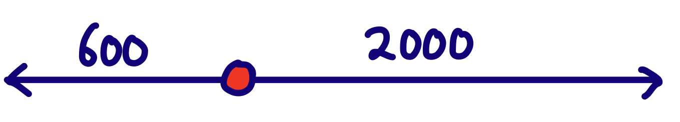
   b. $F = BQv$ $\quad v = F/BQ$

   c. $F = mv^2 / r$ $\quad v = \sqrt{\frac{Fr}{m}}$

   d. $\Delta f / f = v / c$ $\quad v = \frac{\Delta f c}{f}$

3. The driving force of a motorbike's engine is 2 000 N and the resistive force the bike experiences is 600 N. The bike and rider have a total weight of 2800 N.

   Calculate the **acceleration**. Use g = 9.81 N kg^{-1}.



$$F = 2000 - 600 = 1400\text{N}$$

$$m = \frac{W}{g} = \frac{2800}{9.81} = 285.4 \text{ kg}$$

$$a = \frac{F}{m} = \frac{1400}{285.4} = \underline{4.91} \text{ ms}^{-2}$$

11th August

1 2 3

1. Calculate the gradient and hence the **equation** of the straight-line graph that goes through the points (8, 11) and (-3, -22).

$$m = \frac{\Delta y}{\Delta x} = \frac{-22-11}{-3-8} = \frac{-33}{-11} = 3$$

$$y - 11 = 3(x-8)$$

$$y = 3x - 13$$

2. Rearrange the following to make **r** the subject:

   a. $T = Fr$ $\quad r = T/F$

   b. $F = 6\pi\eta r v$ $\quad r = F/6\pi\eta v$

   c. $F = m\omega^2 r$ $\quad r = F/m\omega^2$

   d. $a = v^2 / r$ $\quad r = v^2/a$

3. A mountain biker accelerates for 20 s from rest over a distance of 85 m. The cyclist and their bike have a mass of 110 kg.

   Calculate the **kinetic energy** gained by the cyclist.

$s = 85\ m$

$u = 0\ ms^{-1}$

$v = ?$

$\cancel{a}$

$t = 20s$

$$s = \left(\frac{u+v}{2}\right)t$$

$$v = \frac{2s}{t} - \cancel{u}$$

$$v = \frac{2 \times 85}{20} = 8.5 ms^{-1}$$

$$E_K = \frac{1}{2}mv^2 = \frac{1}{2} \times 110 \times 8.5^2 = 3974$$

$$\approx \underline{4000\ J}$$

12th August

1 2 3

1. Calculate the **equation** of the straight-line graph that goes through the point (9, 3) and has a gradient of -2.

$$y - 3 = -2(x - 9)$$
$$y = -2x + 18 + 3$$
$$y = -2x + 21$$

2. **Describe**, in a practical investigation, what is meant by:

   a. An independent variable

   This is what you decide to change.

   b. A dependent variable

   This is what changes.

   c. A control variable

   This is kept the same to ensure a fair test.

3. Red light has a wavelength of approximately 700 nm, whereas violet light has a wavelength of approximately 400 nm.

   Calculate the **range** of **frequencies** of visible light.

$$f = \frac{c}{\lambda}$$

$$f_{red} = \frac{3.00 \times 10^{8}}{700 \times 10^{-9}} \approx 4.3 \times 10^{14} \text{ Hz}$$

$$\downarrow$$

$$f_{violet} = \frac{3.00 \times 10^{8}}{400 \times 10^{-9}} \approx 7.5 \times 10^{14} \text{ Hz}$$

13th August

1 2 3

1. Calculate the **area**, in m², of a circle with a diameter of:

   a. 0.800 mm

   b. 0.00142 m

   c. 805 μm

   d. 0.10 cm

$A = \frac{\pi d^2}{4}$

$A = 5.03 \times 10^{-7}\ m^2$

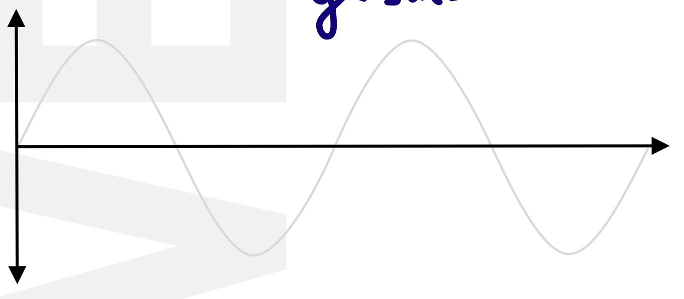
$A = 1.58 \times 10^{-6}\ m^2$

$A = 5.09 \times 10^{-7}\ m^2$

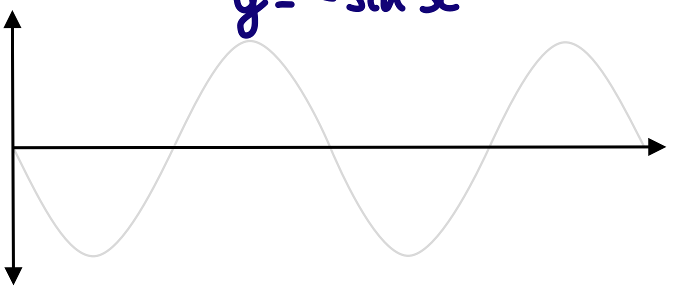
$A = 7.9 \times 10^{-7}\ m^2$

2. Identify the **sinusoidal** curves below and trace the lines.

$y = \sin x$

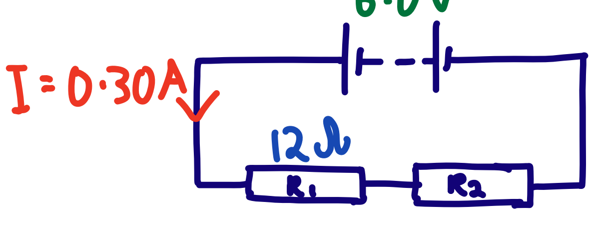


$y = -\sin x$



3. Two resistors are connected in series. The circuit is set up with a 6.0 V battery and has a current of 0.30 A. The first resistor has a resistance of 12 Ω.

   Calculate the **resistance** of the second resistor and the **potential difference** across each of the two resistors.



$V = I R_T \qquad R_T = \frac{V}{I} = \frac{6.0}{0.30} = 20\ \Omega$

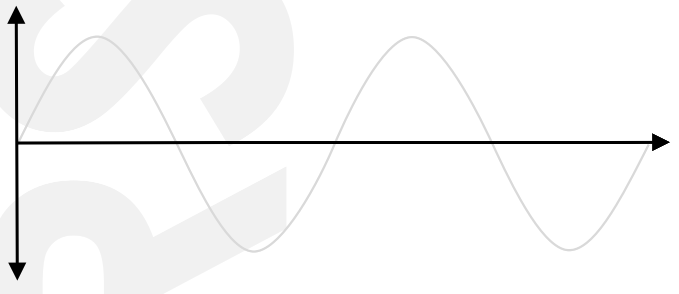
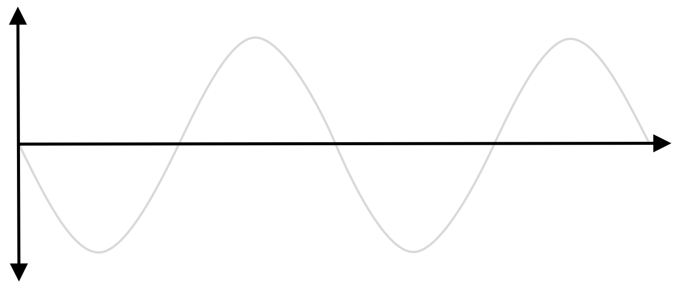
$R_T = R_1 + R_2 \qquad 20 = 12 + R_2 \qquad R_2 = \underline{8.0\ \Omega}$

$R_1 \qquad V_1 = I_1 R_1 = 0.30 \times 12 = \underline{3.6}\ V$

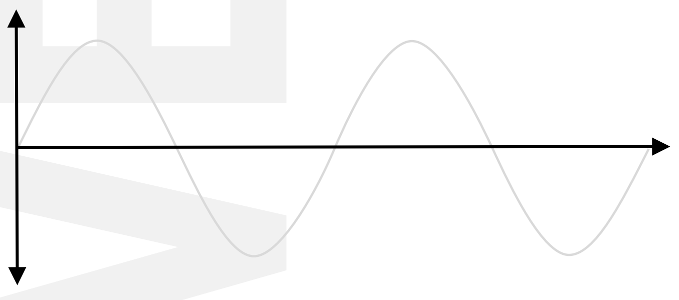
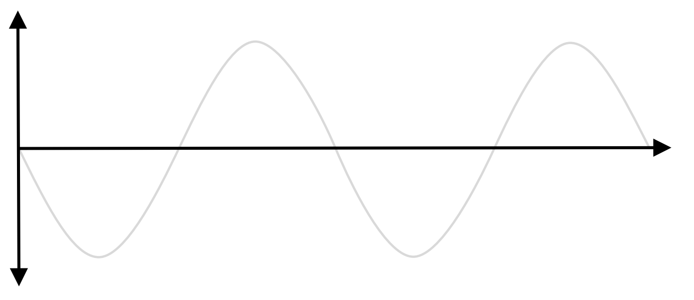
$R_2 \qquad V_T = V_1 + V_2 \qquad V_2 = 6.0 - 3.6 = \underline{2.4}\ V$

14th August

1. Sketch the **sinusoidal** curves with the same frequency and half the amplitude.

2. Sketch the **sinusoidal** curves with the same amplitude and twice the frequency.

3. The half-life of a sample is 3.0 hours and the number of nuclei in the sample is 6.4×10^{10}.

   Calculate the **number** of original nuclei left after 1 day.

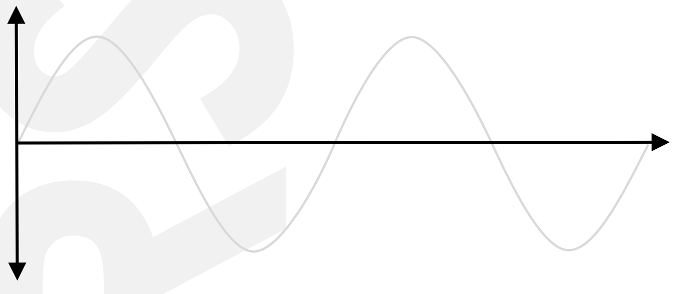
$1 \text{ day} = \frac{24}{3.0} = 8 \text{ half-lives} \qquad \frac{1}{2^8} = \frac{1}{256}$

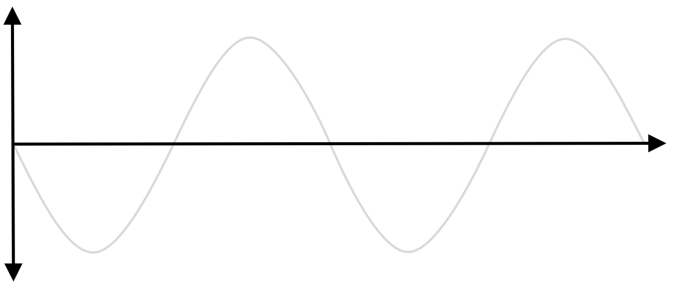
$N = 6.4 \times 10^{10} \times \frac{1}{256} = \underline{2.5 \times 10^{8}} \text{ nuclei}$

15th August

1 2 3

1. Sketch the **sinusoidal** curves with four times the frequency and half the amplitude.





2. Find the **value** and **units** for the following constants:
    a. Avogadro's constant 6.02×10^{23} mol^{-1}
    b. Molar gas constant 8.31 J mol^{-1} K^{-1}
    c. Gravitational constant 6.67×10^{-11} N m^2 kg^{-2}
    d. Elementary charge 1.60×10^{-19} C

3. The pressure of 22.4 cm^3 of a gas at 130˚C is 400 kPa. The pressure is gradually increased to 550 kPa.

   Calculate the **volume**, in m^3, of the gas after it has been compressed, provided the temperature remains constant.

$$p_1 V_1 = p_2 V_2 \qquad V_2 = \frac{p_1}{p_2} V_1 = \frac{400 \times 22.4}{550}$$

$$V_2 = 16.3 \text{ cm}^3$$

$$1 \text{ cm}^3 = 1 \times 10^{-6} \text{ m}^3$$

$$V_2 = \underline{1.63 \times 10^{-5}} \text{ m}^3$$

16th August

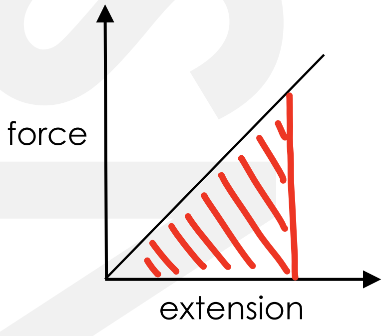
1 2 3

1. Use one of the following symbols; <, <<, > or >>, to describe the **relationship** between:
    a. 10 and 9 — $10 > 9$
    b. 100 and 9 — $100 \gg 9$
    c. 3.7 and 4.1 — $3.7 < 4.1$
    d. 660×10^{-9} and 6.5×10^{-7} — $660 \times 10^{-9} > 6.5 \times 10^{-7}$

    (6.6×10^{-7})

2. Rearrange the following to make $\boldsymbol{\omega_1}$ the subject:
    a. $\omega_2 = \omega_1 + at$ — $\omega_1 = \omega_2 - \alpha t$
    b. $\omega_2^2 = \omega_1^2 + 2a\theta$ — $\omega_1 = \sqrt{\omega_2^2 - 2\alpha\theta}$
    c. $\theta = \omega_1 t + \frac{1}{2}at^2$ — $\omega_1 = \sqrt{\frac{\theta}{t} - \frac{1}{2}\alpha t}$
    d. $\theta = \frac{1}{2}(\omega_1 + \omega_2)t$ — $\omega_1 = \frac{2\theta}{t} - \omega_2$

3. Use the expression for force, F = ke, and the area under a force-extension graph to **derive** an expression for elastic potential energy in terms of spring constant and extension.



$E_e = \text{Area} = \frac{1}{2} Fe \qquad F = ke$

$E_e = \frac{1}{2} ke\, e$

$E = \frac{1}{2} ke^2$

17th August

1 2 3

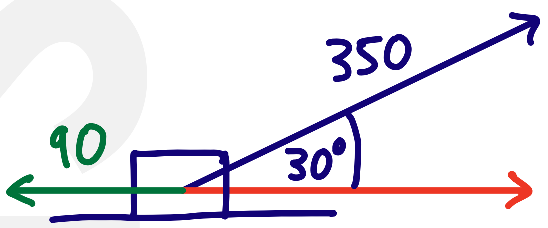
Mass of: Earth Venus The Sun

1. Use one of the following symbols; <, <<, > or >>, to describe the **relationship** between:
   a. 5.97×10^{24} and 4.87×10^{24} $5.97\times10^{24} > 4.87\times10^{24}$
   b. 5.97×10^{24} and 1.99×10^{30} $5.97\times10^{24} \ll 1.99\times10^{30}$
   c. 5.97×10^{24} and 6 000 000 000 000 000 000 000 000 000 000 $5.97\times10^{24} \ll 6.00\times10^{30}$
   d. The mass of an electron and 1×10^{-30} $9.11\times10^{-31} < 1\times10^{-30}$

2. Rearrange the following to make **λ** the subject:
   a. $v = f\lambda$ $\lambda = v/f$
   b. $d \sin\theta = n\lambda$ $\lambda = d\sin\theta/n$
   c. $w = \lambda D / s$ $\lambda = ws/D$
   d. $\theta = \lambda / D$ $\lambda = D\theta$

3. An explorer pulls a sled at 30˚ to the horizontal with a force of 350 N but the friction of the snow resists the motion with a force of 90 N. The sled initially accelerates at 1.6 m s^{-2}.

   Calculate the sled's **mass**.

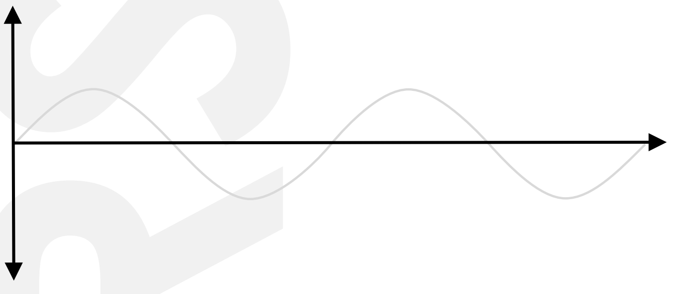


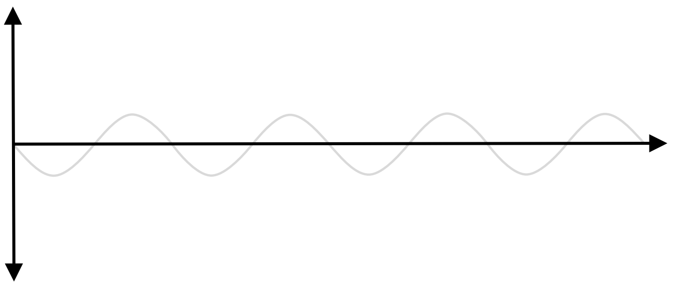
$F = ma$ $m = \frac{F}{a} = \frac{350\cos 30 - 90}{1.6} = 133$

≈ 130 kg

18th August

1. Sketch **sinusoidal** curves with double the frequency and twice the amplitude.





2. Rearrange the following to make **r** the subject:

   a. $V = kQ / r$ $\quad r = kQ/V$

   b. $E = kQ / r^2$ $\quad r = \sqrt{kQ/E}$

   c. $F = kQ_1Q_2 / r^2$ $\quad r = \sqrt{\frac{kQ_1Q_2}{F}}$

   d. $F = GMm / r^2$ $\quad r = \sqrt{\frac{GMm}{F}}$

3. A large catapult has a spring constant of 6 000 N m^{-1} and is extended by 2.00 m. An object is fired vertically upwards and reaches a maximum height of 430 m.

   Calculate the **mass** of the object.

$$E_e = E_p$$

$$\frac{1}{2} k e^2 = m g \Delta h$$

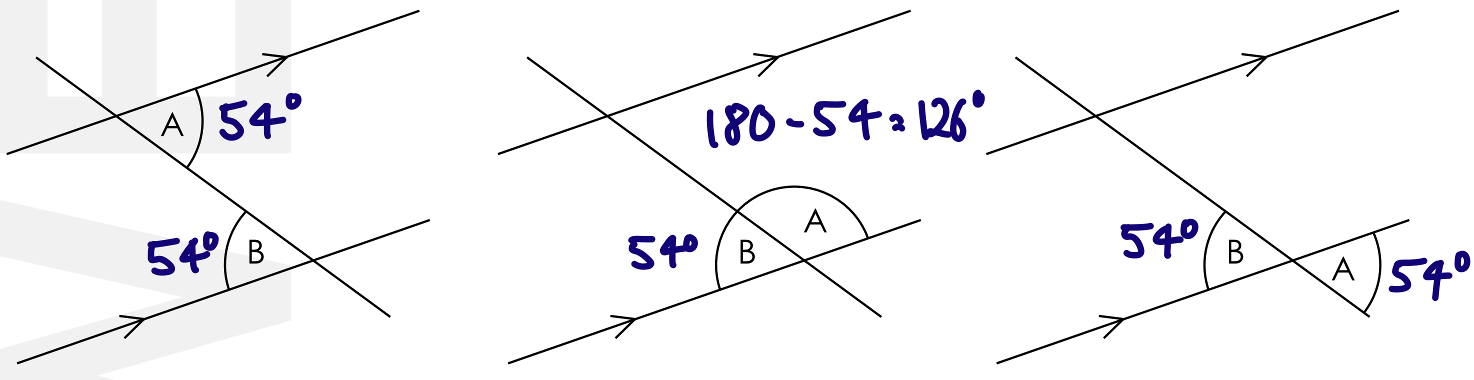
$$m = \frac{ke^2}{2g\Delta h} = \frac{6000 \times 2.00^2}{2 \times 9.81 \times 430} = 2.84\ \text{kg}$$

19th August

1 2 3

1. Sketch a **sinusoidal** curve on the axis below.

2. Write down the value of **A** if B = 54˚.



3. Below is part of a table of a student's results from a practical, which was repeated 5 times.

Force / N	2.2	2.3	2.2	1.2	2.1
Extension / mm	10	10	10	10	10

a. Identify the **anomaly**

b. Calculate the **average** force needed to extend the spring by 10 mm

$$\frac{2.2 + 2.3 + 2.2 + 2.1}{4} = 2.2\,N$$

Don't use the anomalous data

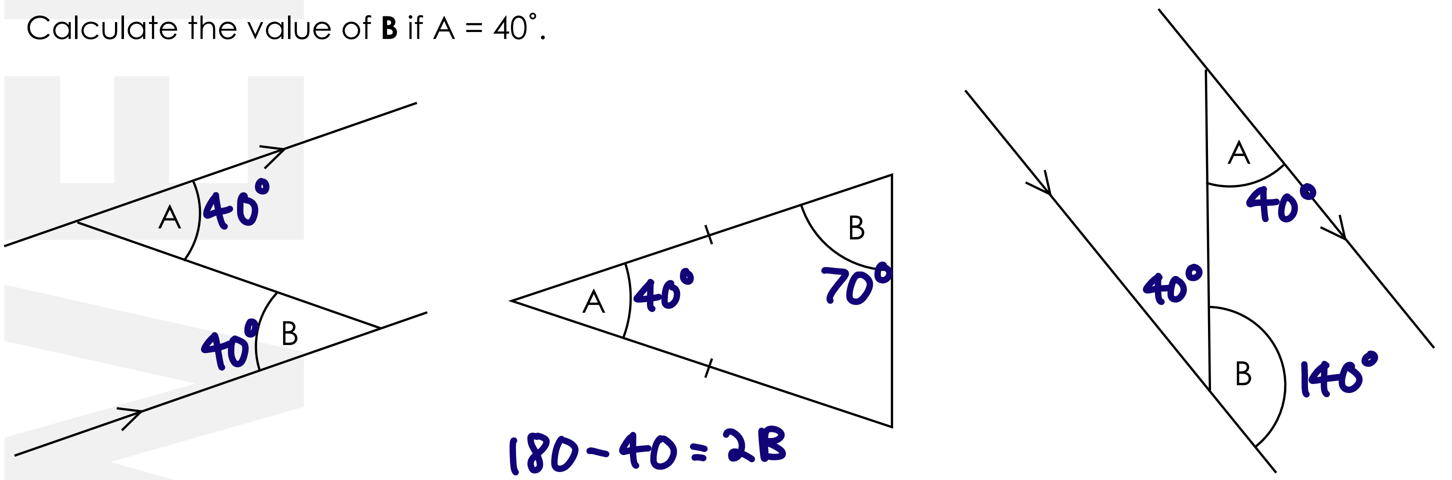
20th August

1 2 3

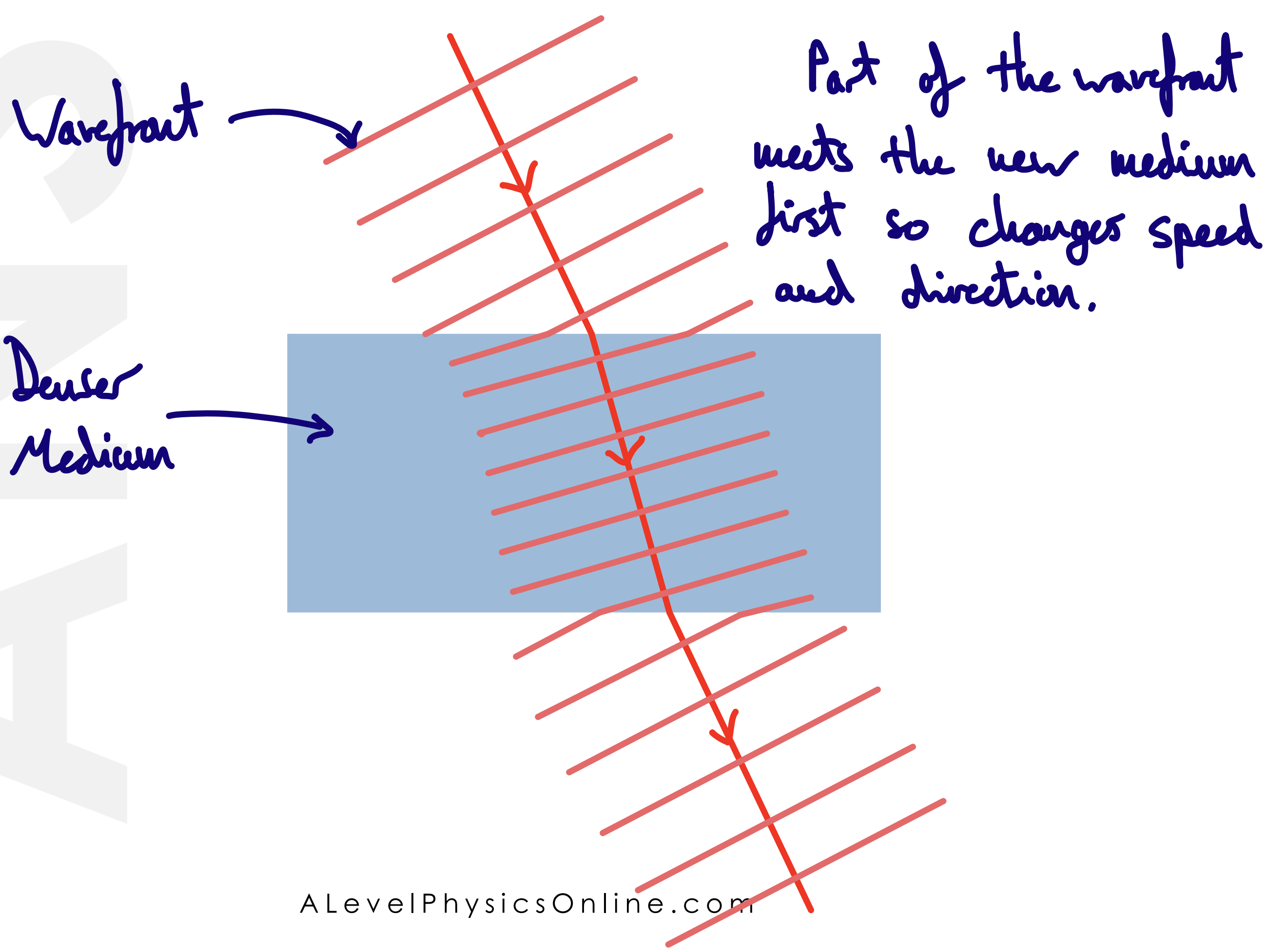
1. Use one of the following symbols; <, <<, > or >>, to describe the **relationship** between the:
    a. Mass of the Earth and the mass of the Sun $m_{Earth} << m_{Sun}$
    b. Mass of a proton and neutron $m_p < m_n$
    c. Mass of a proton and an electron $m_p >> m_e$
    d. Mass of a black hole and the mass of the Sun black hole $>> m_{Sun}$ *

* Some black holes can have stellar masses!

2. Calculate the value of **B** if A = 40˚.



3. Using a wavefront diagram, explain how **refraction** occurs as a wave crosses a boundary between two media.

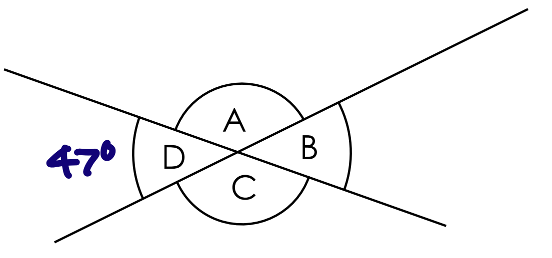


21st August

1. Sketch a **sinusoidal** curve on the axis below.

2. a. Write down the **sum** of A and B

$A + B = 180°$

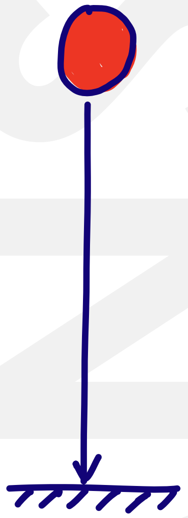


b. Write down the value of **C** if D = 47°

$C = 180 - 47$

$C = 133°$

3. A netball held at rest at a height of 1.45 m is dropped by a player. Calculate the **speed** of the ball just before it hits the floor and how **long** it takes to fall.



$s = 1.45\text{ m}$

$u = 0\text{ ms}^{-1}$

$v = ?$

$a = 9.81\text{ ms}^{-2}$

$t = ?$

$v^2 = \cancel{u^2} + 2as$

$v = \sqrt{2 \times 9.81 \times 1.45}$

$v = \underline{5.33}\text{ ms}^{-1}$

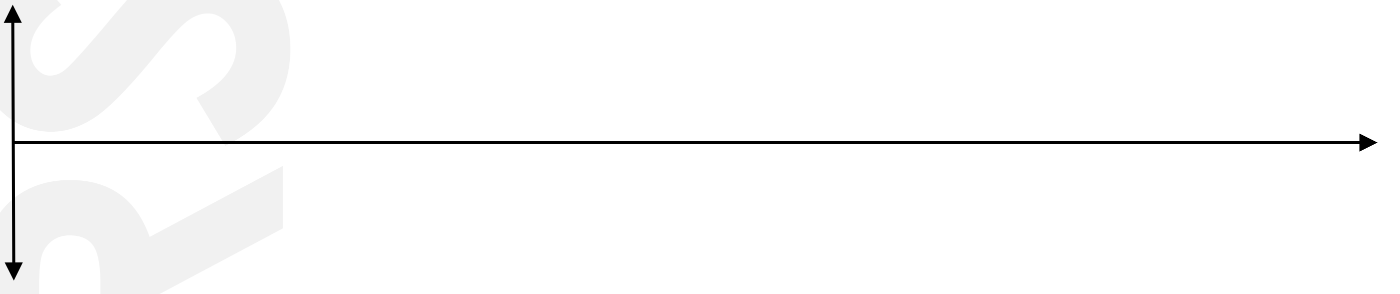
$v = u + at$

$t = \frac{v-u}{a} = \frac{5.33}{9.81} = \underline{0.544\text{ s}}$

22nd August

1 2 3

1. Sketch a **sinusoidal** curve below – this should be better than the one you drew yesterday!

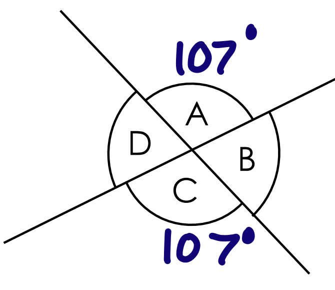


2. a. Write down the **relationship** between D and B

D = B

b. Write down the value of **A** if C = 107˚

107°



3. Write down the general formula for **alpha** decay on an element, X, with mass number, A, and atomic number, Z.

Describe what happens in the nucleus when this occurs.

$${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}\alpha \quad ({}^{4}_{2}He \text{ sometimes used})$$

Two protons and two neutrons ejected from an unstable nucleus.

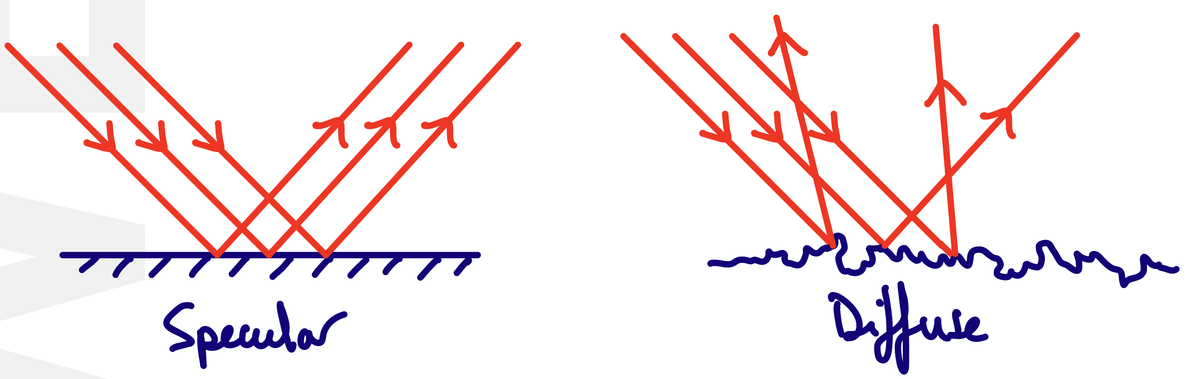
23rd August

1 2 3

1. Define the **conservation of linear momentum**.

$P_{before} = P_{after}$ for a closed system.

2. Describe the phenomena of **reflection**. Include explanations for both specular and diffuse reflection.



3. Calculate the **depth** someone would need to dive to, in order to experience a pressure increase equal to that of atmospheric pressure.

(p_{atm} = 101 kPa and ρ_{water} = 1 000 kg m^{-3})

$$\Delta p = \rho g \Delta h$$

$$\Delta h = \frac{\Delta p}{\rho g} = \frac{101\times10^{3}}{1000\times9.81} = \underline{10.3}\,m$$

24th August

1 2 3

1. Define the **amplitude** of a wave.

Max displacement from its equilibrium position.

2. Describe the **difference** between conventional DC current and how electrons move in a real circuit.

DC from +ve to −ve

Electrons move from −ve to +ve

3. Explain why **increasing** the time over which a force acts, **decreases** the risk of injury during a crash. Include appropriate equations to help support your answer.

$F = ma$ $\quad F = \frac{mv - mu}{t}$ $\quad F = \frac{\Delta p}{\Delta t}$

For the same change in momentum:

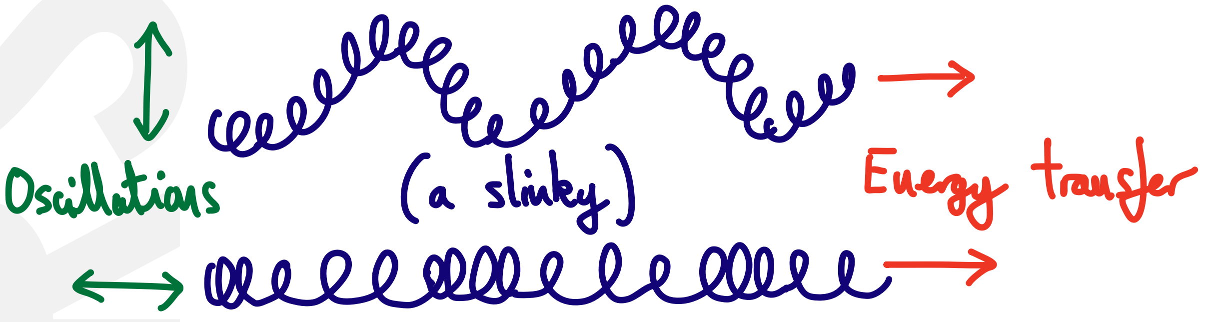
$F \propto \frac{1}{t}$

Increasing the collision time decreases the force experienced.

25th August

1 2 3

1. Define **longitudinal** and **transverse** waves – a diagram may be useful.



2. Describe the effect that decreasing the **volume** of a gas has on its **pressure** if the temperature remains constant. Explain why this happens.

$pV = \text{constant} \quad \therefore \quad p \propto \frac{1}{V}$

More collisions per second so the pressure increases.

3. Write down the general formula for **beta minus** decay of an element, X, with mass number, A, and atomic number, Z.

   Describe what happens in the nucleus when this occurs.

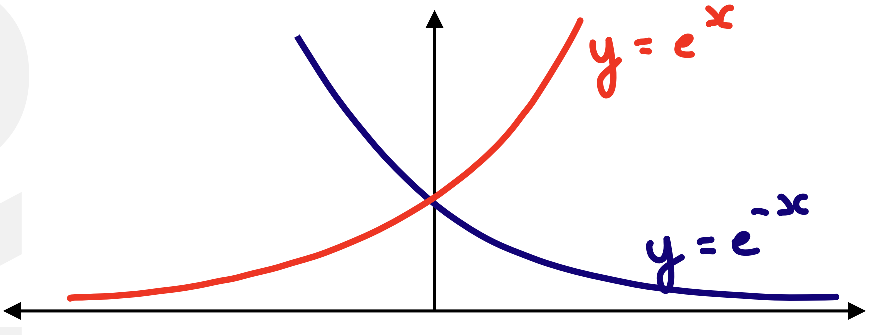
$${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}\beta$$ (${}^{0}_{-1}e$ sometimes used)

A neutron changes into a proton. To conserve charge a negative electron is ejected from the nucleus.

26th August

1 2 3

1. **Sketch** the graphs of $y = e^x$ and $y = e^{-x}$ on the same axis.



2. Describe the effect that decreasing the **temperature** of a gas has on its **pressure** if the volume remains constant. Explain why this happens.

$T \propto p$

As the temperature decreases the molecules slow down, so they don't collide with the walls of a container with as much force. This means the pressure decreases.

3. A rocket, which has a mass of 3.00 x 10⁵ kg accelerates vertically upwards such that it reaches a velocity of 200 m s⁻¹ at a height of 5.00 km.

   Calculate the total **kinetic** and **gravitational potential** energy the rocket has gained from the chemical store of the rocket fuel, assuming its mass is unchanged and that the gravitational field strength is still 9.81 N kg⁻¹ at that height.

$E_{Total} = E_K + E_p$ (Assuming mass of rocket stays constant)

$E_{Total} = \frac{1}{2}mv^2 + mg\Delta h$

$E_{Total} = \left(\frac{1}{2} \times 3.00\times10^5 \times 200^2\right) + (3.00\times10^5 \times 9.81 \times 5000)$

$E_{Total} = \underline{2.07\times10^{10}}\ J$

27th August

1 2 3

1. Define **specific heat capacity**.

The energy required to raise one kg of a substance by one kelvin (one degree Celsius).

2. Describe the effect that increasing the **temperature** of a gas has on its **volume**, if the pressure remains constant. Explain why this happens.

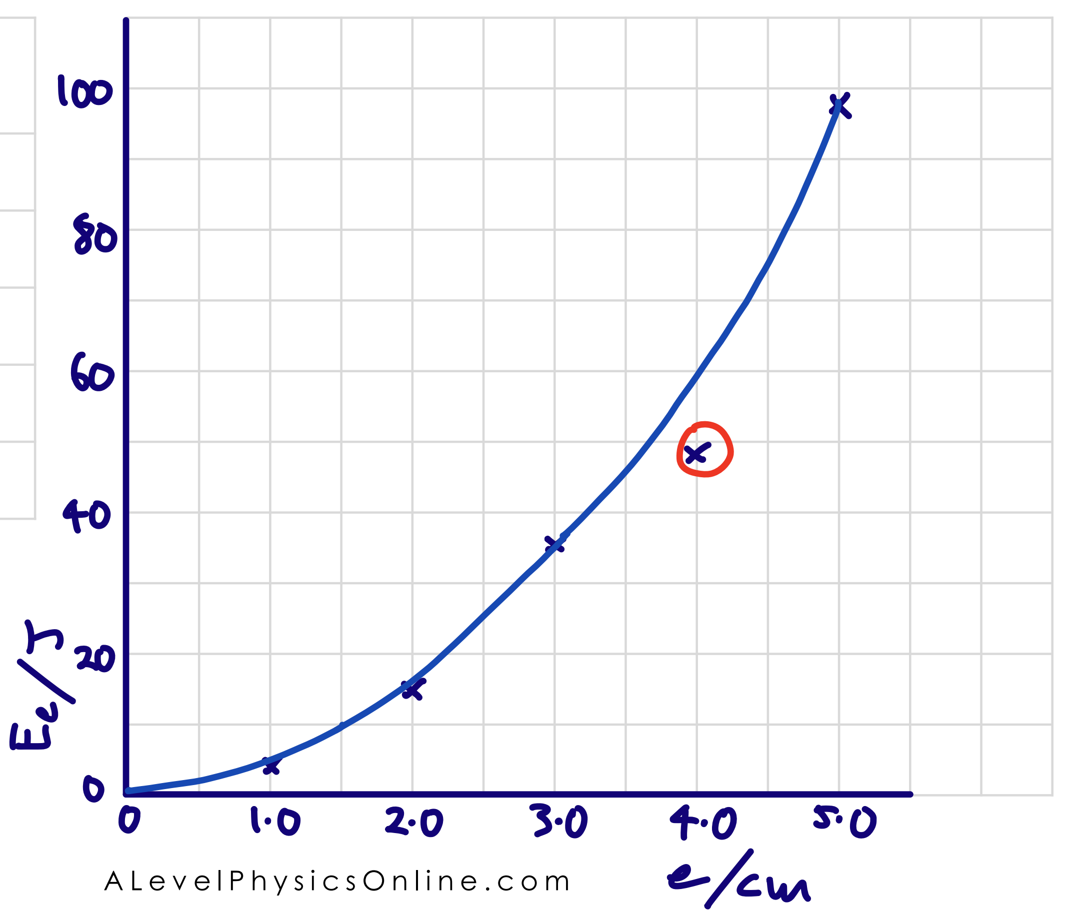
$T \propto V$

Provided the pressure remains constant, increasing the temperature also increases the volume the gas occupies.

3. Below is a table of results from a practical investigation with a spring.

Plot the points on a graph and draw an **appropriate** line of best fit.

Extension / cm	Energy / J
1.0	4.0
2.0	15
3.0	36
4.0	48
5.0	98



28th August

1 2 3

1. Calculate **sinθ** for the following values of θ. Give your answers to 3 decimal places.
   a. 0˚ 0.000
   b. 30˚ 0.500
   c. 45˚ 0.707
   d. 60˚ 0.866
   e. 90˚ 1.000

Check your calculator is set to degrees not radians.

2. **Derive** the relationship between force and momentum from the equations for force ($F = ma$), acceleration ($a = \Delta v / t$) and momentum ($p = mv$).

$F = ma \qquad a = \frac{v-u}{t}$

$F = m\left(\frac{v-u}{t}\right)$

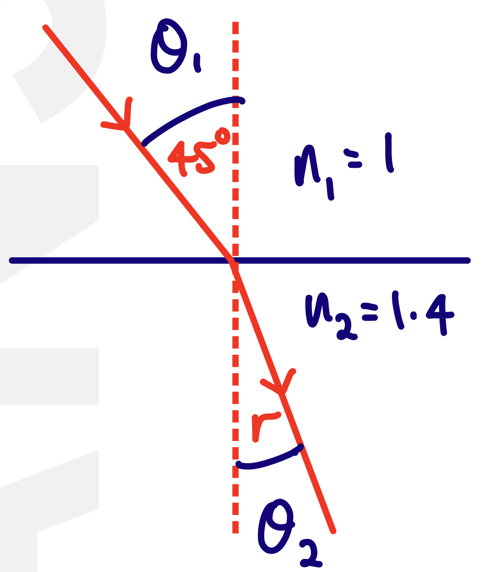
$F = \frac{mv - mu}{t}$

$p = mv$

$F = \frac{\Delta p}{\Delta t}$

3. A light ray passes into a transparent block of material from the air. The refractive index of the block is 1.4 and the angle of incidence is 45˚.

   Using Snell's Law ($n_1 \sin\theta_1 = n_2 \sin\theta_2$) calculate the **angle of refraction**.



$n_1 \sin\theta_1 = n_2 \sin\theta_2$ r

$\theta_2 = \sin^{-1}\left(\frac{\sin\theta_1}{n_2}\right)$

$\theta_2 = \sin^{-1}\left(\frac{\sin 45}{1.4}\right)$

$\theta_2 = 30°$

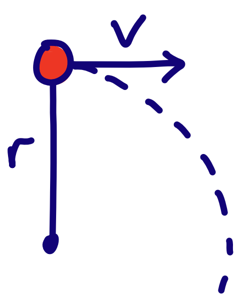
29th August

1 2 3

1. Calculate **cosθ** for the following values of θ. Give your answers to 3 decimal places.
   a. 0˚ 1.000
   b. 30˚ 0.866
   c. 45˚ 0.707
   d. 60˚ 0.500
   e. 90˚ 0.000

Compare these to the values from yesterday.

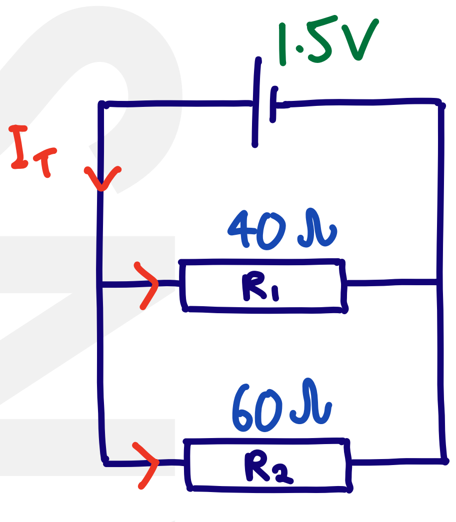
2. Describe how an object can **accelerate** if its **speed** is **constant**.



Objects moving with circular motion have a constant speed but a changing velocity.

3. Two resistors, of resistance 40 Ω and 60 Ω, are connected in parallel to a 1.5 V cell.

   Calculate the **current** through each resistor and the total current drawn from the cell.



$$I_1 = \frac{1.5}{40} = 0.0375 = \underline{0.038}\text{ A}$$

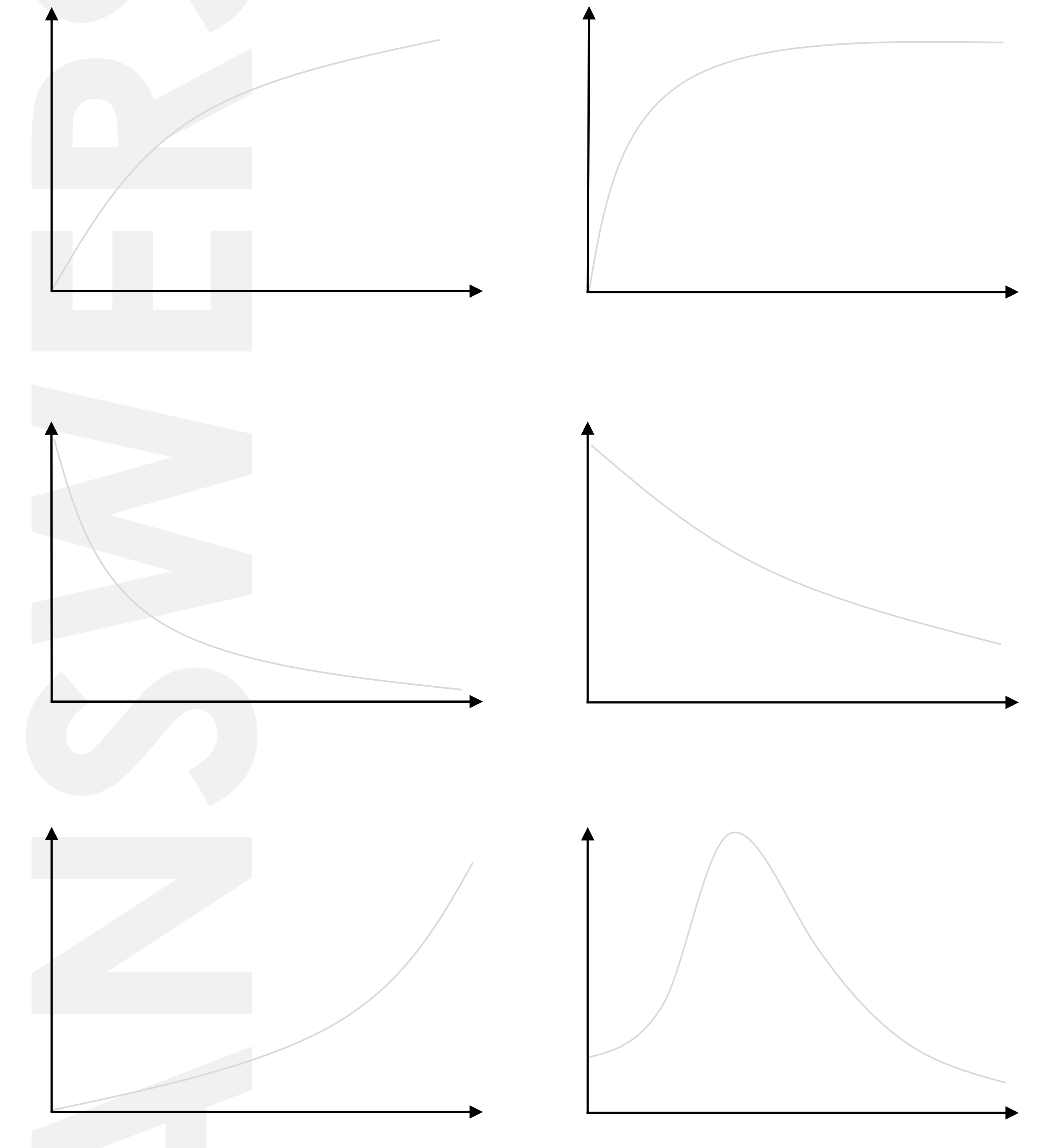
$$I_2 = \frac{1.5}{60} = \underline{0.025}\text{ A}$$

$$I_{Total} = I_1 + I_2 = 0.0375 + 0.025 = \underline{0.063}\text{ A}$$

30th August - Part 1

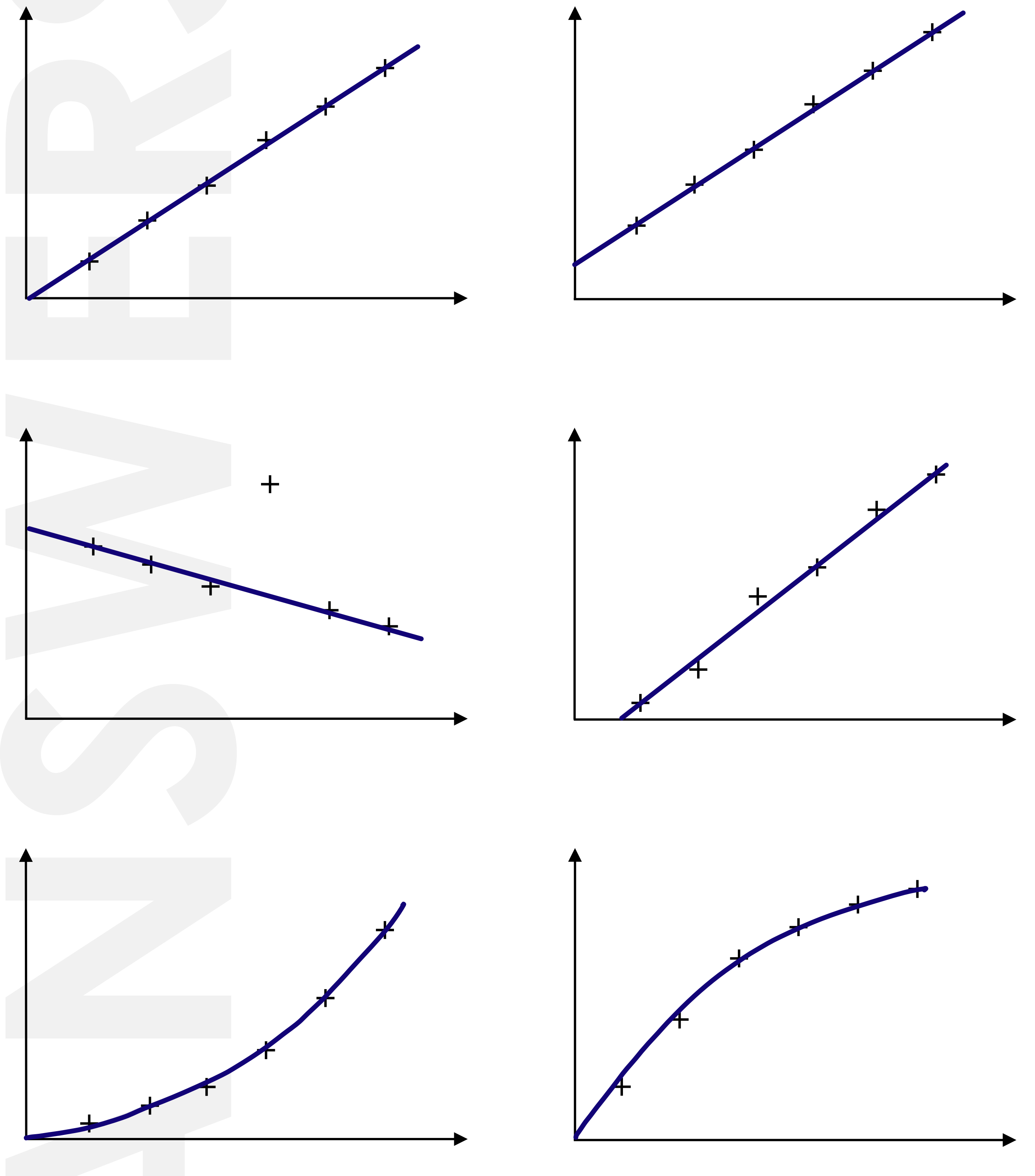
1

1. Trace the following **curves**.



30th August - Part 2

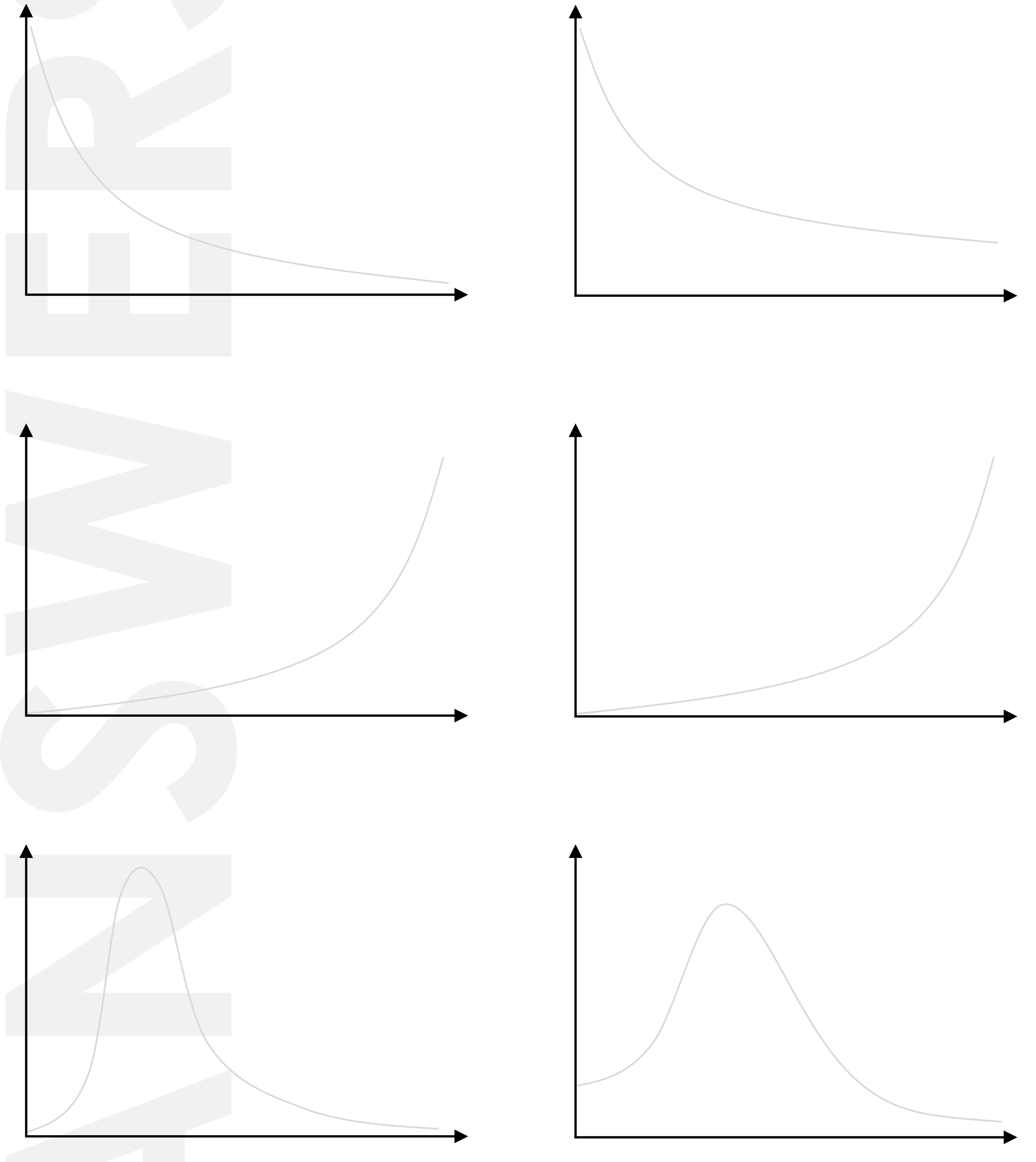
2. Draw an appropriate **line of best fit** for the following graphs.



31st August - Part 1

1

1. Trace the following **curves**.



31st August - Part 2

2. Draw an appropriate **line of best fit** for the following graphs.