Further Mechanics

A-Level Further Mathematics · Vocabulary in context

Word	Example
Further Mechanics /ˈfɜːðə mɪˈkænɪks/	**Further Mechanics** covers collisions, circular motion and springs.
elastic /ɪˈlæstɪk/	A rubber band is **elastic**: it goes back to its shape.
projectile /prəˈdʒektaɪl/	A **projectile** moves under gravity alone, after it is launched.
horizontal /ˌhɒrɪˈzɒntl/	The floor is **horizontal**.
vertical /ˈvɜːtɪkl/	A falling stone moves in a **vertical** line.
position /pəˈzɪʃn/	The **position** of the car is its distance from the start.
speed /spiːd/	The bus moves at a **speed** of 15 m/s. 15 m/s
gravity /ˈgrævɪti/	**Gravity** pulls the ball back down.
particle /ˈpɑːtɪkl/	Modelling the ball as a **particle** means we ignore its size and any rotation.
air resistance /eə rɪˈzɪstəns/	**Air resistance** slows down a falling leaf.
drag /dræg/	**Drag** slows down a boat in the water.
velocity /vəˈlɒsɪti/	The ball's **velocity** is 5 m/s to the left. 5 m/s
displacement /dɪˈspleɪsmənt/	After walking 3 km east, your **displacement** is 3 km east. 3 km 3 km

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angle of projection /ˈæŋgl ɒv prəˈdʒekʃn/	The **angle of projection** is measured from the horizontal.
velocity component /vəˈlɒsɪti kəmˈpəʊnənt/	A launch at 30° has a vertical **velocity component** of u/2. 30° u/2
constant acceleration /ˈkɒnstənt əkˌseləˈreɪʃn/	A falling stone has **constant acceleration** of about 9.8 m/s^2. 9.8 m/s^2
greatest height /ˈgreɪtɪst haɪt/	At its **greatest height**, the ball still moves sideways.
range /reɪndʒ/	The **range** of the ball is how far it lands from where it started.
time of flight /taɪm ɒv flaɪt/	The **time of flight** of the ball is 2 s. 2 s
trajectory /trəˈdʒektəri/	The ball's **trajectory** is a curve.
Cartesian equation /kɑːˈtiːzɪən ɪˈkweɪʒn/	The **Cartesian equation** links x and y directly. x y
parabola /pəˈræbələ/	A thrown ball follows a **parabola**.
collision /kəˈlɪʒn/	Two cars stopped after a **collision**.
equilibrium /ˌiːkwɪˈlɪbrɪəm/	The book is in **equilibrium** because the forces balance.
rigid body /ˈrɪdʒɪd ˈbɒdi/	A wheel can be treated as a **rigid body**.
turning effect /ˈtɜːnɪŋ ɪˈfekt/	A longer spanner gives a bigger **turning effect**.
coplanar forces /ˌkəʊˈpleɪnə ˈfɔːsɪz/	**Coplanar forces** all act in the same plane.

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moment /ˈməʊmənt/	A long spanner gives a larger **moment**.
line of action /laɪn ɒv ˈækʃn/	The **line of action** of the weight passes through the centre of gravity.
perpendicular distance /ˌpɜːpənˈdɪkjʊlə ˈdɪstəns/	Measure the **perpendicular distance** from the pivot to the force.
perpendicular /ˌpɜːpənˈdɪkjʊlə/	The wall is **perpendicular** to the floor.
pivot /ˈpɪvət/	The see-saw turns about its **pivot**.
separate /ˈsepəreɪt/	**Separate** the variables before you integrate.
resultant force /rɪˈzʌltənt fɔːs/	If the **resultant force** is zero, the speed does not change.
parallel /ˈpærəlel/	Two springs side by side, in **parallel**, are stiffer.
centre of mass /ˈsentə ɒv mæs/	The **centre of mass** of a ruler is in its middle.
uniform /ˈjuːnɪfɔːm/	The weight of a **uniform** rod acts at its middle.
symmetry /ˈsɪmətri/	A parabola has a line of **symmetry**.
density /ˈdensɪti/	Iron has a higher **density** than wood, so it sinks in water.
lamina /ˈlæmɪnə/	A **lamina** is a flat shape with no thickness.
median /ˈmiːdiːən/	A **median** joins a corner of a triangle to the middle of the opposite side.

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Word	Example
hemispherical shell /ˌhemɪsˈferɪkl ʃel/	A thin bowl is a **hemispherical shell**.
circular arc /ˈsɜːkjʊlə ɑːk/	Bend the wire into a **circular arc**.
circular sector /ˈsɜːkjʊlə ˈsektə/	A **circular sector** looks like a slice of pizza.
composite body /ˈkɒmpəzɪt ˈbɒdi/	A **composite body** is made of several simple shapes.
free-body diagram /friː ˈbɒdi ˈdaɪəgræm/	Draw a **free-body diagram** with an arrow for each force.
normal reaction /ˈnɔːml rɪˈækʃn/	The **normal reaction** pushes up on a box sitting on a table.
friction /ˈfrɪkʃn/	**Friction** between the tyres and the road stops the car sliding.
sliding /ˈslaɪdɪŋ/	The block is **sliding** down the smooth slope.
coefficient of friction /ˌkəʊɪˈfɪʃənt ɒv ˈfrɪkʃn/	The **coefficient of friction** μ shows how rough two surfaces are. μ
limiting friction /ˈlɪmɪtɪŋ ˈfrɪkʃn/	The block slides when the push is bigger than the **limiting friction**.
limiting equilibrium /ˈlɪmɪtɪŋ ˌiːkwɪˈlɪbrɪəm/	In **limiting equilibrium**, the box is just about to slide.
tension /ˈtenʃn/	The **tension** in the rope holds up the lamp.
toppling /ˈtɒplɪŋ/	A tall box is close to **toppling** on a slope.

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Word	Example
base of support /beɪs ɒv sə'pɔ:t/	It stays up if its weight acts inside the **base of support**.
topple /'tɒpl/	The tall block may **topple** over.
inertia /ɪ'nɜ:ʃə/	**Inertia** keeps you moving forward when a bus stops suddenly.
centrifugal /ˌsentrɪ'fju:gl/	Do not add a **centrifugal** force when you work from the ground.
taut /tɔ:t/	A **taut** string is pulled straight.
tangent /'tændʒənt/	Draw a **tangent** to the curve to find the gradient at one point.
angular speed /'æŋgjʊlə spi:d/	The wheel turns with an **angular speed** of 2 radians per second. 2
linear speed /'lɪnɪə spi:d/	At the same angular speed, a bigger radius gives a bigger **linear speed**.
period /'pɪərɪəd/	The **period** of the wave is 0.02 s. 0.02 s
frequency /'fri:kwənsi/	A **frequency** of 50 Hz means 50 waves every second. 50 Hz 50
radial /'reɪdɪəl/	The field lines are **radial**: they point straight out from the centre.
centripetal acceleration /sen'trɪpɪtl əkˌselə'reɪʃn/	A car turning a corner has a **centripetal acceleration**.
tangential /tæn'dʒenʃl/	The stone flies off in a **tangential** direction.

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vertical circle /'vɜːtɪkl 'sɜːkl/	A ball on a string swung over your head moves in a **vertical circle**.
centripetal force /sen'trɪpɪtl fɔːs/	The string gives the **centripetal force** to the spinning ball.
horizontal circle /ˌhɒrɪ'zɒntl 'sɜːkl/	A car on a roundabout moves in a **horizontal circle**.
conical pendulum /'kɒnɪkl 'pendjʊləm/	A ball on a string swinging in a circle is a **conical pendulum**.
work /wɜːk/	You do **work** when you push a box across the floor.
energy conservation /'enədʒi ˌkɒnsə'veɪʃn/	Use **energy conservation** to link speed and height.
slack /slæk/	A **slack** string is loose.
turning point /'tɜːnɪŋ pɔɪnt/	The **turning point** is the top or bottom of the curve.
normal contact force /'nɔːml 'kɒntækt fɔːs/	The **normal contact force** pushes at right angles to the surface.
loss of contact /lɒs ɒv 'kɒntækt/	**Loss of contact** happens when the reaction force becomes zero.
Hooke's law /hʊks lɔː/	**Hooke's law** says the extension is proportional to the force.
extension /ek'stenʃn/	The **extension** of the spring is 4 cm. 4 cm
natural length /'nætʃərəl leŋθ/	The **natural length** is the length before stretching.

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Word	Example
modulus of elasticity /ˈmɒdjʊləs ɒv ɪlæˈstɪsɪti/	The **modulus of elasticity** tells you how stiff a string is.
stiffness /ˈstɪfnəs/	A stiff spring has high **stiffness**.
compression /kəmˈpreʃn/	**Compression** makes the file smaller.
elastic potential energy /ɪˈlæstɪk pəˈtenʃl ˈenədʒi/	A stretched spring stores **elastic potential energy**.
kinetic energy /kɪˈnetɪk ˈenədʒi/	A fast car has a lot of **kinetic energy**.
series /ˈsɪəriːz/	Springs in **series** stretch more than one spring.
compress /kəmˈpres/	Push the spring to **compress** it by 0.1 m. 0.1 m
variable force /ˈveərɪəbl fɔːs/	A spring gives a **variable force**: it grows as the spring stretches.
differential equation /ˌdɪfəˈrenʃl ɪˈkweɪʒn/	A **differential equation** links a quantity and its rate of change.
chain rule /tʃeɪn ruːl/	Use the **chain rule** for a function inside another function.
separable differential equation /ˈsepərəbl ˌdɪfəˈrenʃl ɪˈkweɪʒn/	A **separable differential equation** lets you put x and y on different sides. x y
separable /ˈsepərəbl/	$dy/dx = xy$ is **separable**. $dy/dx = xy$
integrate /ˈɪntɪgreɪt/	**Integrate** acceleration to find velocity.
initial condition /ɪˈnɪʃl kənˈdɪʃn/	The **initial condition** states the capacitor's starting voltage.

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Word	Example
boundary condition /ˈbaʊndəri kənˈdɪʃn/	The **boundary condition** is that the fixed end does not move.
terminal velocity /ˈtɜːmɪnl vəˈlɒsɪti/	At **terminal velocity**, the falling object stops speeding up.
partial fractions /ˈpɑːʃl ˈfrækʃnz/	Use **partial fractions** to split $1/[s(s+1)]$ into $1/s$ minus $1/(s+1)$. $1/[s(s+1)] \quad 1/s \quad 1/(s+1)$
momentum /məʊˈmentəm/	A heavy truck has a lot of **momentum**.
linear momentum /ˈlɪnɪə məʊˈmentəm/	**Linear momentum** is mass times velocity.
conservation of momentum /ˌkɒnsəˈveɪʃn ɒv məʊˈmentəm/	**Conservation of momentum** means the total momentum stays the same.
conservation of linear momentum /ˌkɒnsəˈveɪʃn ɒv ˈlɪnɪə məʊˈmentəm/	**Conservation of linear momentum** applies when no resultant external force acts.
line of impact /laɪn ɒv ˈɪmpækt/	The **line of impact** passes through the point of contact.
line of centres /laɪn ɒv ˈsentəz/	The **line of centres** joins the centres of two spheres.
direct impact /daɪˈrekt ˈɪmpækt/	In a **direct impact**, both spheres move along the line of centres.
oblique impact /əˈbliːk ˈɪmpækt/	In an **oblique impact**, the ball hits the wall at an angle.
Newton's experimental law /ˈnjuːtnz ekˌsperɪˈmentl lɔː/	**Newton's experimental law** links the speeds before and after a collision.

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Word	Example
% **coefficient of restitution** /ˌkəʊɪˈfɪʃənt ɒv rɪstɪˈtjuːʃn/	Find the **coefficient of restitution** from approach and separation speeds.
↔ **perfectly elastic** /ˈpɜːfektlɪ ɪˈlæstɪk/	In a **perfectly elastic** collision, no kinetic energy is lost.
inelastic /ɪnɪˈlæstɪk/	Clay is **inelastic**: it stays bent.
— **perfectly inelastic** /ˈpɜːfektlɪ ɪnɪˈlæstɪk/	In a **perfectly inelastic** collision, objects stick together.
reduced mass /rɪˈdjuːst mæs/	For two equal masses m, the **reduced mass** is m/2. m m/2
deflection /dɪˈflekʃn/	The needle shows a large **deflection**.
fixed surface /fɪkst ˈsɜːfɪs/	A ball bouncing off a **fixed surface** keeps its speed along the wall.
radian /ˈreɪdɪən/	One full turn is an angle of 2π **radians**. 2π

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