## Text Description automatically generated

**Revision checklist**

The tables below can be used as a revision checklist: **It doesn’t contain all the detailed knowledge you need to know, just an overview.** For more detail see the syllabus and talk to your teacher.

[A Level Further Mathematics A – H245 specification.](https://www.ocr.org.uk/Images/308752-specification-accredited-a-level-gce-further-mathematics-a-h245.pdf)

The table headings are explained below:

| **OCR Reference.** | **Content Description**  (unshaded content is AS content) | **R** | **A** | **G** | **Notes** |
| --- | --- | --- | --- | --- | --- |
| Each item of content has a unique specification reference code.   * **Mathematics A – H240**  1. Mathematics A: Pure 2. Mathematics A: Statistics 3. Mathematics A: Mechanics  * **Further Mathematics A – H245**  1. Further Mathematics A: Pure Core 2. Further Mathematics A: Statistics Option 3. Further Mathematics A: Mechanics Option 4. Further Mathematics A: Discrete Option 5. Further Mathematics A: Additional Pure | | You can use the tick boxes to show when you have revised an item and how confident you feel about it.  R = **RED** means you are really unsure and lack confidence; you might want to focus your revision here and possibly talk to your teacher for help  A = **AMBER** means you are reasonably confident but need some extra practice  G = **GREEN** means you are very confident.  As your revision progresses, you can concentrate on the **RED** and **AMBER** items in order to turn them into **GREEN** items.  You might find it helpful to highlight each topic in red, orange or green to help you prioritise. | | | You can use the notes column to:   * add more information about the details for each point * add formulae or notes * include a reference to a useful resource. * Highlight areas of difficulty or things that you need to talk to your teacher about or look up in a textbook. |

You must be able to use all the formulae and identities given for the Pure Core mandatory strand of A Level Further Mathematics, without those formulae and identities being provided, either in these forms or in equivalent forms. Those formulae and identities may only be provided where they are the starting point for a proof or as a result to be proved.

Additionally, for the mechanics option, you must know and be able to use the following

**Mechanics**

**Forces and Equilibrium**

Weight = mass 

Friction: 

Newton’s second law in the form: 

**Kinematics**

For motion in a straight line with variable acceleration:









Learners will be given a Formulae Booklet in each assessment which has both the A Level Mathematics and the A Level Further Mathematics formulae (the version used for AS has only the AS Maths and Further Maths formulae).

**Mechanics option formulae**

**Mechanics**

**Kinematics**

|  |  |
| --- | --- |
| Motion in a straight line | Motion in two dimensions |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Newton’s experimental law**

Between two smooth spheres 

Between a smooth sphere with a fixed plane surface 

**Motion in a circle**

Tangential velocity is 

Radial acceleration is  or  towards the centre

Tangential acceleration is 

**Centres of mass**

Triangular lamina:  along median from vertex

Solid hemisphere, radius *r*: from centre

Hemispherical shell, radius *r*: from centre

Circular arc, radius *r*, angle at centre 2*α*:  from centre

Sector of circle, radius *r*, angle at centre 2*α*:  from centre

Solid cone or pyramid of height *h*: above the base on the line from centre of base to vertex

Conical shell of height *h*: above the base on the line from centre of base to vertex

## Content of Mechanics (Optional paper Y543)

| **OCR Reference** | **Content Description**  (unshaded content is AS content) | **R** | **A** | **G** | **Notes** |
| --- | --- | --- | --- | --- | --- |
| **6.01a** | a) Be able to find the dimensions of a quantity in terms of M, L and T, and understand that some quantities are dimensionless.  *Includes understanding and using the notation* [*d*] *for the dimension of the quantity d.*  *Learners are expected to know or be able to derive the dimensions of any quantity for which they know the units. Dimensions of other quantities will be given, or their derivation will be the focus of assessment.* |  |  |  |  |
| **6.01b** | b) Understand and be able to use the relationship between the units of a quantity and its dimensions. |  |  |  |  |
| **6.01c** | c) Be able to use dimensional analysis as an error check.  *e.g. Verify the relationship that power is proportional to the product of the driving force and the velocity.* |  |  |  |  |
| **6.01d** | d) Be able to use dimensional analysis to determine unknown indices in a proposed formulation.  *e.g. Determine the period of oscillation of a simple pendulum in terms of its length, mass and the acceleration due to gravity, g.* |  |  |  |  |
| **6.01e** | e) Be able to formulate models and derive equations of motion using a dimensional argument. |  |  |  |  |
| **6.02a** | a) Understand the concept of work done by a force. |  |  |  |  |
| **6.02c** | c) Be able to calculate the work done by a constant force in two dimensions using vectors  or by a variable force  in one dimension only. |  |  |  |  |
| **6.02b** | b) Be able to calculate the work done by a constant force.  *The force may not act in the direction of motion of the body and so learners will be expected to resolve forces in two dimensions*. |  |  |  |  |
| **6.02d** | d) Understand the concept of the mechanical energy of a body.  *i.e. the kinetic and potential energy.* |  |  |  |  |
| **6.02f** | f) Be able to calculate the kinetic energy of a body using the scalar product .  *Learners may be expected to use the formula , in solving a variety of problems, for example in calculating the kinetic energy of a body.* |  |  |  |  |
| **6.02e** | e) Be able to calculate the gravitational potential energy  and kinetic energy  of a body. |  |  |  |  |
| **6.02g** | g) Understand and be able to use Hooke’s law, in the form , for elastic strings and springs.  *Includes an informal understanding of when Hooke’s Law does not apply.* |  |  |  |  |
| **6.02h** | h) Be able to calculate the elastic potential energy  stored in a string or spring.  *Learners will be expected to state the formula for the elastic potential energy stored in a string or spring unless they are explicitly asked to derive it*. |  |  |  |  |
| **6.02i** | i) Understand and be able to use the principle of the conservation of mechanical energy and the work-energy principle for dynamic systems, including consideration of energy loss.  *Learners will only need to consider kinetic and gravitational potential energy.* |  |  |  |  |
| **6.02j** | j) Extend their knowledge of the principle of the conservation of mechanical energy and the work-energy principle to systems which include elastic strings or springs. |  |  |  |  |
| **6.02k** | k) Understand and be able to use the definition of power (the rate at which a force does work).  *Includes  .* |  |  |  |  |
| **6.02l** | l) Be able to use the relationship between power, the tractive force and velocity  to solve problems.  *e.g. Motion on an inclined plane*.  *Includes maximum velocity and speed.*  *Learners will be required to resolve forces in two dimensions.* |  |  |  |  |
| **6.02m** | m) Be able to calculate the power associated with a variable force in two dimensions using the scalar product . |  |  |  |  |
| **6.03a** | a) Recall and be able to use the definition of linear momentum in one dimension. |  |  |  |  |
| **6.03c** | c) Recall and be able touse the definition of momentum in two dimensions including the vector form . |  |  |  |  |
| **6.03b** | b) Understand and be able to apply the principle of conservation of linear momentum in one dimension applied to two particles.  *Includes using the formula .* |  |  |  |  |
| **6.03d** | d) Understand and be able to apply the principle of conservation of linear momentum in two dimensions applied to two particles.  *Includes using the vector form .* |  |  |  |  |
| **6.03e** | e) Understand and be able to use the concept of the impulse imparted by a force. |  |  |  |  |
| **6.03f** | f) Be able to use the relationship between the instantaneous impulse of a force and the change in momentum .  *The instantaneous impulse is the impulse associated with an instantaneous change in velocity.*  *Learners will only be required to apply this to instantaneous events in one dimension.*  *e.g.*  *The direct impact of two smooth spheres.*  *An impulsive force acting in the direction of an inelastic string*.  *Questions involving collisions(s) between particles may include multiple collisions and the conditions under which further collisions occur.* |  |  |  |  |
| **6.03g** | g) Understand and be able to apply the impulse - momentum principle in two dimensions including the vector form .  *e.g.*  *The oblique impact of two smooth spheres.*  *A smooth sphere with a fixed plane surface*.  *An impulsive force acting at an angle to an inelastic string.* |  |  |  |  |
| **6.03h** | h) Understand and be able to apply the impulse - momentum principle for a constant force expressed as force  time or for a variable force in one dimension only as . |  |  |  |  |
| **6.03i** | i) Recall and be able to use the definition of the coefficient of restitution, including .  *[Superelastic collisions are excluded.]* |  |  |  |  |
| **6.03j** | j) Understand and be able to use the terms “perfectly elastic”  and “inelastic”  for describing collisions.  *Learners should know that for perfectly elastic collisions there will be no loss of kinetic energy and for inelastic collisions the bodies coalesce and there is maximum loss of kinetic energy.* |  |  |  |  |
| **6.03k** | k) Recall and be able to use Newton’s experimental law in one dimension for problems of direct impact.  e.g. *Between two smooth spheres  and a smooth sphere with a fixed plane surface , where  and  are the velocities before and after impact.* |  |  |  |  |
| **6.03l** | l) Extend their knowledge to problems involving Newton’s experimental law in two dimensions.  *e.g. The oblique impacts of two smooth spheres and a smooth sphere with a fixed plane surface.*  *Questions may involve the velocity expressed as a two dimensional vector.* |  |  |  |  |
| **6.04a** | a) Understand and be able to apply the principle that the effect of gravity is equivalent to a single force acting at the body’s centre of mass.  *Includes understanding that, in terms of linear motion, a rigid body may be modelled by a particle of the same mass at its centre of mass.* |  |  |  |  |
| **6.04b** | b) Be able to find the position of the centre of mass of a uniform rigid body using symmetry, for example a rectangular lamina. |  |  |  |  |
| **6.04c** | c) Be able to determine the centre of mass of a system of particles or the centre of mass of a composite rigid body.  *Questions may involve any of the rigid bodies listed in the Formulae Booklet, but will be limited to compound shapes such as a uniform L-shaped lamina or a hemisphere abutting a cylinder with a common axis*.  *Includes composition by addition or subtraction, for example a rectangular lamina with a semicircle attached to one side, or a rectangular lamina with a semicircle removed.* |  |  |  |  |
| **6.04d** | d) Be able to use integration to determine the position of the centre of mass of a uniform lamina or a uniform solid of revolution. |  |  |  |  |
| **6.04e** | e) Be able to solve problems involving the equilibrium of a single rigid body under the action of coplanar forces.  *e.g. Suspension of a rigid body from a given point or problems involving the toppling or sliding of a rigid body placed on an inclined plane*.  *May include rigid bodies which are hinged to a surface.*  *[Hinged bodies are excluded.]* |  |  |  |  |
| **6.05a** | a) Understand and be able to use the definitions of angular velocity, velocity, speed and acceleration in relation to a particle moving in a circular path, or a point rotating in a circle, with constant speed.  *Includes the use of bothand* |  |  |  |  |
| **6.05b** | b) Be able to use and apply the relationships , , for motion in a circle with constant speed. |  |  |  |  |
| **6.05c** | c) Be able to solve problems regarding motion in a horizontal circle.  *e.g.*  *Motion of a conical pendulum.*  *Motion on a banked track*.  *Problems will be restricted to those involving constant forces but learners will be required to resolve forces in two dimensions*. |  |  |  |  |
| **6.05d** | d) Understand the motion of a particle in a circle with variable speed.  *In ‘Stage 1’ Learners will be expected to use energy considerations to calculate the speed of a particle at a given point on a circular path.* |  |  |  |  |
| **6.05e** | e) Extend their understanding of the motion of a particle in a circle with variable speed to include the radial and tangential components of the acceleration. |  |  |  |  |
| **6.05f** | f) Be able to solve problems involving motion round a vertical circle including motion which is not restricted to a circular path.  *This is restricted to a combination of motion in a circle and free fall.*  *e.g. The subsequent motion of a particle moving on the outside of a smooth circular surface*.  *The motion of a particle on a string moving in a vertical circle and then as a projectile.* |  |  |  |  |
| **6.06a** | a) Be able to use  or  to model the linear motion of a particle under the action of a variable force in one dimension only.  *Learners will be required to solve problems in which the corresponding differential equation can be solved by either the method of separation of variables or an integrating factor*. |  |  |  |  |



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