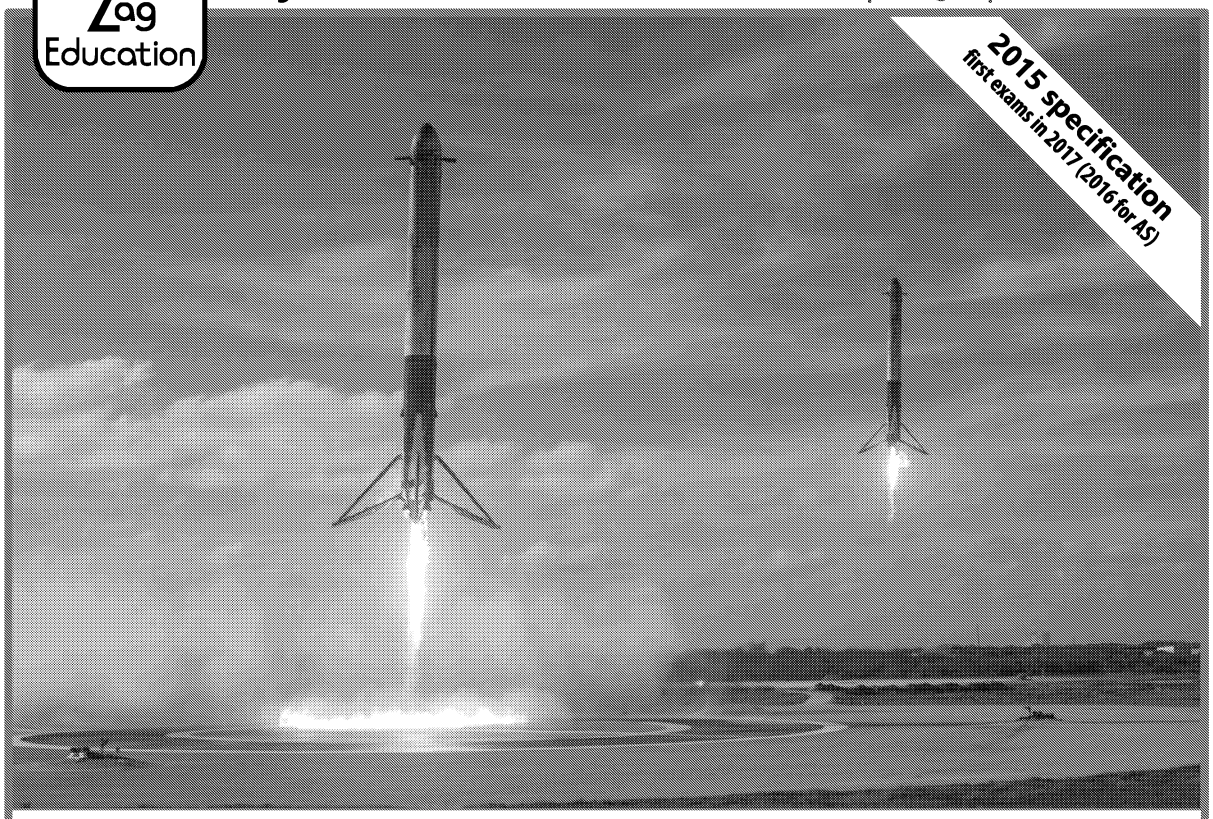
Zig Zag Education

Physics

A Level | AQA | 7407/7408



Revision Grids for AS and A Level AQA Year One Physics

Unit 4: Mechanics and Materials

zigzageducation.co.uk

POD 8246a

Contents

Teacher's Introduction

These learning grids are designed to help your students independently learn content and help you to assess their knowledge during teaching of each section of Unit 4 – Mechanics and materials – within the AQA A Level Year 1 and AS Physics specification. The concept is that your students are assigned a set of pages to read from the relevant book and are then asked to complete the relevant learning grids, possibly for homework or as a refresher for a topic. These activities are particularly useful for students who need more support, but they contain some thought-provoking reasoning questions which will stimulate highly engaged students.

This resource directly references:

AQA Physics A Level Year 1 Student Book;
2nd edition;
Breithaupt;
Oxford, 2015

AQA A Level Physics Year 1 and AS Student Book ;
Kelly;
HarperCollins, 2015

AQA A Level Physics Student Book 1 (AQA A level Science);
England, Davenport, Pollard, Thomas;
Hodder Education, 2015

Each learning grid is closely linked to the AQA 2015 specification and to the approved textbooks. Relevant textbook page numbers are provided at the top of each worksheet, to allow easy cross-referencing. Separate resources cover Units 1, 2, 3 and 5.

Each learning grid contains a range of question styles, including:

- **Quick-testing questions** – these may be a phrase, a definition or a numeric response
- **Missing-information/Match-terms-to-definitions questions** – test key knowledge quickly
- **Explain-a-process questions** – encourage students to recognise cause and effect in physical processes
- **Graph questions** – will require understanding of how to draw graphs, use log scales and interpret data
- **Applied knowledge questions** – challenge students to apply knowledge in unfamiliar situations
- **Experiment time** – asks students to analyse a practical, interpret its results and recognise strengths and weaknesses

Learning grids in this section will on average take 20–30 minutes each. However, this resource includes substantial opportunities to develop mathematics skills, and students who find maths challenging may find that these resources take longer to complete.

These resources can be used to engage students and allow those who have missed lessons to catch up quickly. They can be the basis for a homework exercise, and the answer scheme allows them to be easily used in cover lessons. Students could also use the worksheets as an independent learning and revision resource.

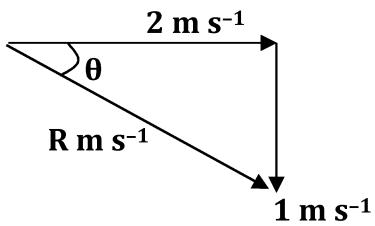
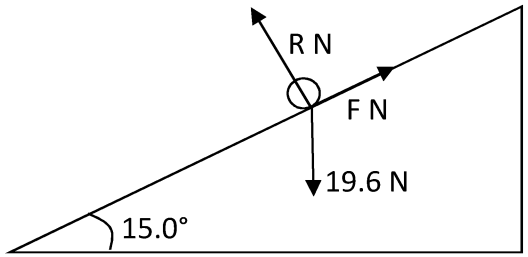
Remember!
Always check the exam board website for new information, including changes to the specification and sample assessment material.

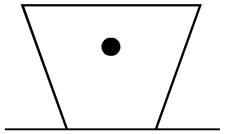
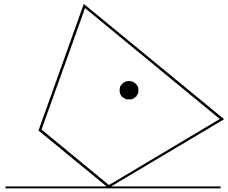
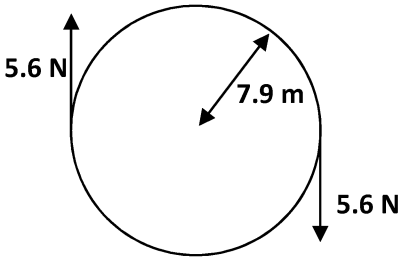
All resources can be photocopied in black and white. We hope you and your students enjoy using this resource!

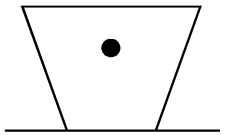
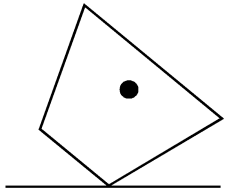
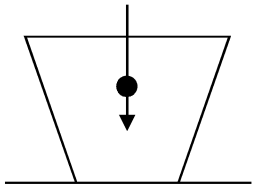
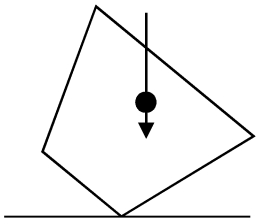
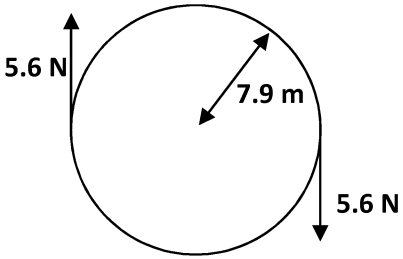
Selected Question and Answer Pages

For demonstration only, the sample answer pages immediately
follow their corresponding question pages

	Question	Answer			
3.4.1.1 Scalars and vectors	**Jenny swims east in a river at 1 m s^{-1}, with respect to the current.** **The river's current flows at 2 m s^{-1} to the west.** **(a) Calculate Jenny's resultant velocity.** **(b) Which direction does Jenny travel in, taking into account the current?**	**(a)**	**(b)**		
	Jenny wanted to swim from one side of the riverbank to the other. The current was travelling at 2 m s^{-1} in the easterly direction, and Jenny was about to swim from north to south at a velocity of 1 m s^{-1}. **(a) Draw a vector triangle of Jenny's velocity.** **(b) Calculate Jenny's resultant velocity.** **(c) Calculate the direction of Jenny's motion.**	**(a)**	**(b)**	**(c)**	
	A ball of mass 2.00 kg was rolled down a hill of slope 15.0°. The ball was moving at a constant speed down the hill. The ball experienced a reaction force from the hill and a friction force from the hill. **(a) Draw a labelled force diagram of this.** **(b) Calculate the reaction force.** **(c) Calculate the friction force.**	**(a)**	**(b)**	**(c)**	

	Question	Answer		
3.4.1.1 Scalars and vectors	**Jenny swims east in a river at 1 m s^{-1}, with respect to the current.** **The river's current flows at 2 m s^{-1} to the west.** **(a) Calculate Jenny's resultant velocity.** **(b) Which direction does Jenny travel in, taking into account the current?**	**(a)** -1 m s^{-1} + 2 m s^{-1} = 1 m s^{-1}	**(b)** West	
	Jenny wanted to swim from one side of the riverbank to the other. The current was travelling at 2 m s^{-1} in the easterly direction, and Jenny was about to swim from north to south at a velocity of 1 m s^{-1}. **(a) Draw a vector triangle of Jenny's velocity.** **(b) Calculate Jenny's resultant velocity.** **(c) Calculate the direction of Jenny's motion.**	**(a)**  	**(b)** $R = \sqrt{2^2 + 1^2} = 2.2 \text{ m s}^{-1}$	**(c)** $\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{1}{2}$ $\theta = \tan^{-1}(1/2)$ $= 26.6°$ clockwise of east
	A ball of mass 2.00 kg was rolled down a hill of slope 15.0°. The ball was moving at a constant speed down the hill. The ball experienced a reaction force from the hill and a friction force from the hill. **(a) Draw a labelled force diagram of this.** **(b) Calculate the reaction force.** **(c) Calculate the friction force.**	**(a)**  	**(b)** R = 19.6 R = 18.9	

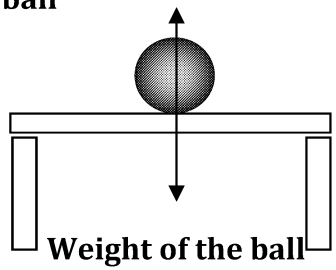
	Question	Answer	
3.4.1.2 Moments	**State and explain whether the objects below are stable or will topple.** **(a)**  **(b)** 		
	Describe an example of how pivots are used in the human body.		
	A steering wheel is turned with equal and opposite forces of 10 N at each end of the wheel's diameter. **The diameter of the wheel is 30 cm.** **Calculate the moment of the couple on the steering wheel.**		
	Calculate the moment of the couple in the system below. 		

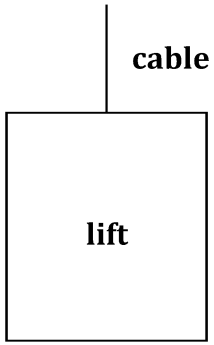
	Question	Answer	
3.4.1.2 Moments	**State and explain whether the objects below are stable or will topple.** **(a)**  **(b)** 	This object will not topple because the centre of mass acts through the base of the object. It is stable. 	This object will topple because the centre of mass does not act through the base of the object. 
	Describe an example of how pivots are used in the human body.	In the human body, joints are pivots and they enable us to lift heavy weights.	
	A steering wheel is turned with equal and opposite forces of 10 N at each end of the wheel's diameter. **The diameter of the wheel is 30 cm.** **Calculate the moment of the couple on the steering wheel.**	moment of a couple = one of the forces in a couple × perpendicular distance between the forces moment = 10 × 0.3 moment = 3 N m	
	Calculate the moment of the couple in the system below. 	moment of couple = one of the forces in a couple × perpendicular moment=5.6×(2×7.9) moment = 88 N m	

	Question	Answer
3.4.2.2 The Young modulus	**Describe an experiment to find the Young modulus of a metal wire.**	

	Question	Answer
3.4.2.2 The Young modulus	**Describe an experiment to find the Young modulus of a metal wire.**	Apparatus • Long, thin piece of wire • Clamp • Ruler • Marker pen • Selection of different masses • Pulley • Micrometer Method • Fix one end of the wire to the clamp and run it over the pulley at the end of the bench. • Straighten the wire by hanging a small mass from its end. • Mark a point on the wire. • Using the ruler, measure the distance between the marked point of the wire and the fixed end of the wire. • Attach another mass to the wire; record its weight. • Measure the distance between the marked point of the wire and the fixed end of the wire. • Calculate the extension using a Vernier scale and by subtracting the original length from this distance. • Record this reading. • Repeat for different weights. • Measure the diameter of the wire using a micrometer at several points along its length. Find the average by adding together the results and dividing by the number of readings. • Calculate the area using: $A = \pi \left(\frac{d}{2}\right)^2$ • Calculate stress for each reading using: $\text{stress} = \frac{\text{force}}{\text{cross-sectional area}}$ • Calculate strain for each reading using: $\text{strain} = \frac{\text{extension}}{\text{original length}}$ • Plot a graph of stress against strain. • Find the gradient – this is the Young modulus.

Additional Selected Question Pages

	Question	Answer
3.4.1.5 Newton's laws of motion	**Explain why the example below is not an example of Newton's third law.** **Push of the table on the ball**  **Weight of the ball** **State and explain the correct law that applies to it.**	
	A ball is hit by a tennis racquet. Describe the forces involved in terms of Newton's third law.	
	A girl of mass m is standing in a lift of mass *M*. The lift starts to accelerate upwards. **Draw a forces diagram to show the force involved.** **Write the resultant force of the lift, and state its direction.**	

	Question	Answer	
3.4.1.5 Newton's laws of motion	**An object of mass 2.3 kg is pushed along the floor with a force of 64 N. The object experiences a frictional force of 15 N.** **(a) Draw a forces diagram to show this.** **(b) Calculate the acceleration of the object.**	**(a)**	**(b)**
	A lift is moving downwards at a constant velocity. **The total mass of the lift is 2.30 tonnes.** **(a) Calculate the tension in the cable.** **(b) State which of Newton's laws is used in this calculation.**  	**(a)** **(b)**	

	Question	Answer
3.4.1.6 Momentum	**Define 'linear momentum'.**	
	State two units that can be used for linear momentum.	
	A ball of mass 500 g rolls along the floor with a velocity of 2 m s^{-1}. **Calculate the linear momentum of the ball.**	
	Define the principle of conservation of momentum.	
	A rifle of mass 3 kg fires a bullet of mass 0.02 kg. The bullet moves with a velocity of 300 m s^{-1}. **Calculate the recoil velocity of the rifle.**	

	Question	Answer
3.4.1.6 Momentum	**In physics, what is meant by Δ?** **Consequently, what is meant by Δp?**	
	Define 'net force'.	
	Define the impulse of a force.	
	Explain how impulse can be measured using a force–time graph.	

