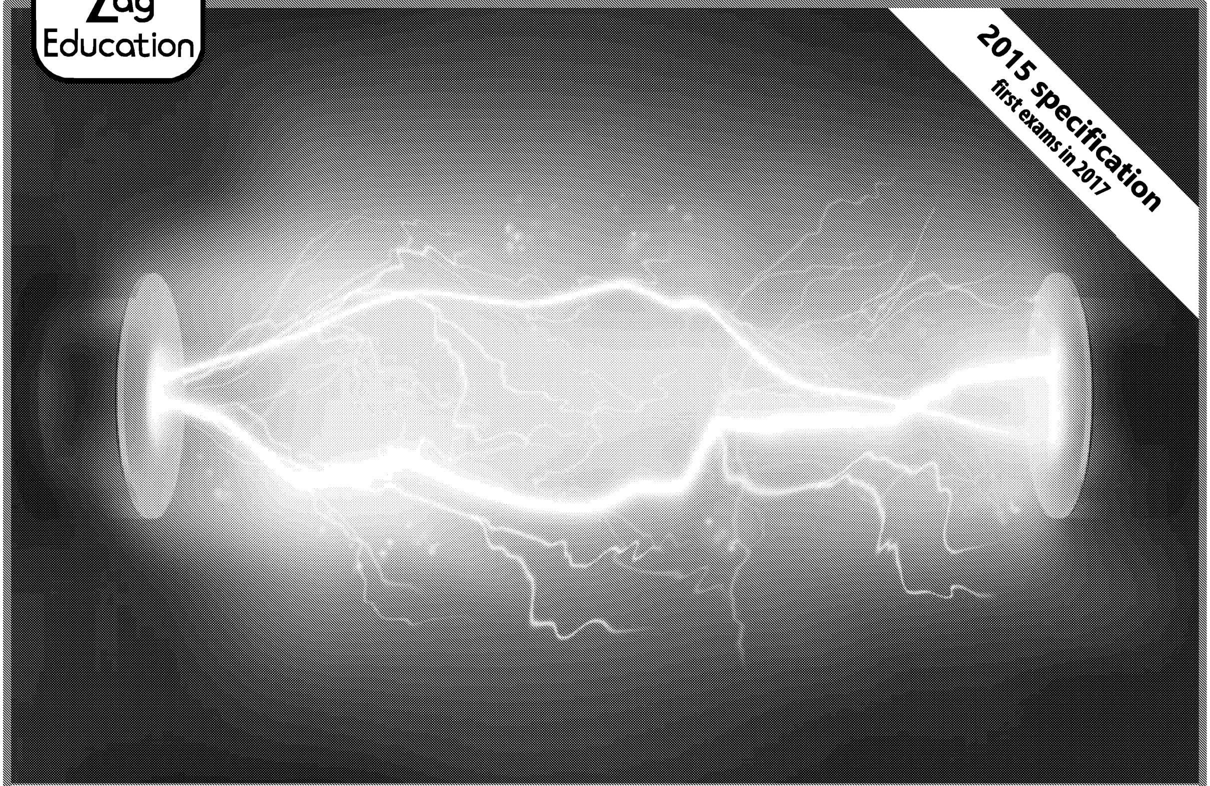
Physics A Level | AQA | 7408



Revision Grids for A Level AQA Physics

Section 7: Fields

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POD 8247a

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 Section 7 – Fields and their consequences, within the AQA A Level Year 2 Physics specification. The concept is that your students are assigned a set of pages to read from the relevant book and then are 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 A Level Physics Year 2, 2nd Edition;
Breithaupt;
Oxford, 2015

AQA A-Level Physics Year 2;
Pharaoh, Bishop & Gidzewicz;
Collins, 2016

AQA A-Level Physics 2;
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 5, 6 and 8.

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.

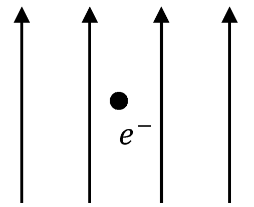
Learning grids in this section will on average take 20–30 minutes each. However, this resource includes substantial opportunities to develop mathematics skills, and students who find maths challenging may find that these resources take longer to complete.

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 sheets as an independent learning and revision resource.
All resources can be photocopied in black and white. We hope you and your students enjoy this resource!

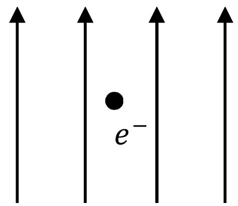
Selected Question and Answer Pages

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

<table>
<tr><th></th><th>Questions</th><th>Answers</th></tr>
<tr><td rowspan="3">7.1 Fields (cont.)</td><td>An electron is placed in an electric field as seen below.

What direction does the electron experience a force in?

</td><td></td></tr>
<tr><td>What can force fields arise from?</td><td></td></tr>
<tr><td>Fill in the table to describe the similarities and differences between electric fields and gravitational fields.</td><td>
<table>
<tr><th></th><th>Gravitational fields</th><th>Electric fields</th></tr>
<tr><td>Affects</td><td></td><td></td></tr>
<tr><td>Attractive or repulsive?</td><td></td><td></td></tr>
<tr><td>Shape of field</td><td>Follows the inverse-square law</td><td></td></tr>
<tr><td>Equipotential surfaces in relation to field lines</td><td></td><td>Equipotentials at right angles to field lines</td></tr>
<tr><td>Potential increases or decreases towards field source?</td><td></td><td></td></tr>
</table>
</td></tr>
</table>

7.1 Fields (cont.)

Questions	Answers
An electron is placed in an electric field as seen below. **What direction does the electron experience a force in?** 	Force is experienced downwards (negative charges experience a force opposite to the direction of the field lines of an electric field).
What can force fields arise from?	Masses (gravitational fields) and charges (electric fields and magnetic fields)
Fill in the table to describe the similarities and differences between electric fields and gravitational fields.	

	Gravitational fields	**Electric fields**
Affects	Masses	Charges
Attractive or repulsive?	Always attractive	Can be attractive or repulsive
Shape of field	**Follows the inverse-square law**	Follows the inverse-square law
Equipotential surfaces in relation to field lines	Equipotentials at right angles to field lines	**Equipotentials at right**
Potential increases or decreases towards field source?	Decreases	

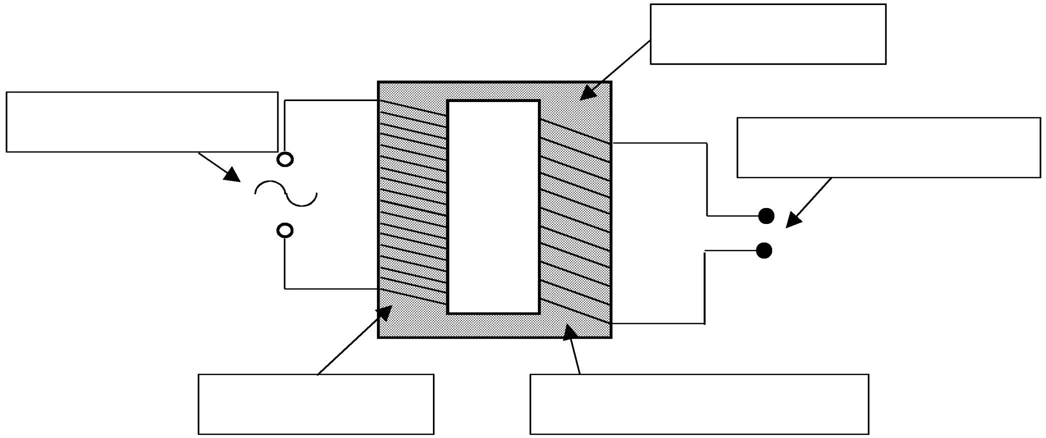
	Questions	Answers
7.2.3 Gravitational potential (cont.)	**Calculate the work done in moving a 45 kg mass through a gravitational potential difference of 68 J kg^{-1}.**	
	Rearrange the equation for the work done moving a mass across a gravitational potential difference for the initial gravitational potential.	
	A 90 kg mass sits in a gravitational field. The field does 1360 J of work to the mass, so that the mass has a potential of -340 J kg^{-1}. Calculate the initial gravitational potential of the mass.	
	What is meant by the term equipotential surface for a gravitational field?	
	How much work is done when moving from one point of an equipotential surface to another point of the same equipotential surface?	
	Complete the diagram to show the gravitational potential around an isolated mass and the equipotential surfaces of the mass.	

7.2.3 Gravitational potential (cont.)

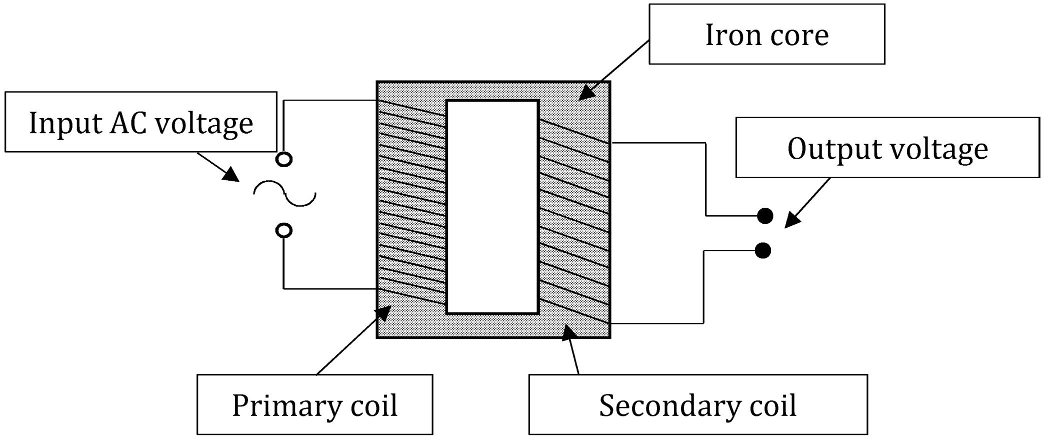
Questions	Answers
Calculate the work done in moving a 45 kg mass through a gravitational potential difference of 68 J kg^{-1}.	$\Delta W = m\Delta V$ $\Delta W = 45 \times 68$ $\Delta W = 3100$ J
Rearrange the equation for the work done moving a mass across a gravitational potential difference for the initial gravitational potential.	$\Delta W = m\Delta V$ $\Delta W = m(V_2 - V_1)$ $V_2 - V_1 = \frac{\Delta W}{m}$ $V_1 = V_2 - \frac{\Delta W}{m}$
A 90 kg mass sits in a gravitational field. The field does 1360 J of work to the mass, so that the mass has a potential of -340 J kg^{-1}. **Calculate the initial gravitational potential of the mass.**	$V_1 = V_2 - \frac{\Delta W}{m}$ (The mass is doing work – equivalent to negative work being done. This relates to the mass falling.) $V_1 = -340 - \frac{1360}{90}$ $V_1 = -355$ J kg^{-1}
What is meant by the term equipotential surface for a gravitational field?	A surface around a body which has an equal gravitational potential at all points.
How much work is done when moving from one point of an equipotential surface to another point of the same equipotential surface?	Zero
Complete the diagram to show the gravitational potential around an isolated mass and the equipotential surfaces of the mass.	Potential – solid lines Equipotential surfaces – dashed lines

Oxford: pp. 153–155 Collins: pp. 165–169 Hodder: pp. 167–171

7.5.6 The operation of a transformer

Questions	Answers
Label the diagram of the transformer opposite.	
Write an equation linking the number of coils in a transformer to the potential difference in the transformer.	
The primary coil of a transformer has four times as many turns in its secondary coil than in its primary coil. The input potential difference is 100 V. Calculate the output potential difference.	
A transformer has a potential difference of 12 kV across its primary coil and a potential difference of 350 V on its secondary coil. The secondary coil of the transformer has 70 turns. Calculate the number of turns on the primary coil of the transformer.	

Oxford: pp. 153–155 Collins: pp. 165–169 Hodder: pp. 167–171

	Questions	Answers
7.5.6 The operation of a transformer	**Label the diagram of the transformer opposite.**	
	Write an equation linking the number of coils in a transformer to the potential difference in the transformer.	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$
	The primary coil of a transformer has four times as many turns in its secondary coil than in its primary coil. **The input potential difference is 100 V.** **Calculate the output potential difference.**	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $V_s = V_p \frac{N_s}{N_p}$ $V_s = 100 \div 4$ $V_s = 25\text{ V}$
	A transformer has a potential difference of 12 kV across its primary coil and a potential difference of 350 V on its secondary coil. **The secondary coil of the transformer has 70 turns.** **Calculate the number of turns on the primary coil of the transformer.**	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $N_p = N_s \frac{V_p}{V_s}$ $N_p = 70 \times \frac{12 \times 10^3}{350}$ $N_p = 2400\text{ turns}$

Additional Selected Question Pages

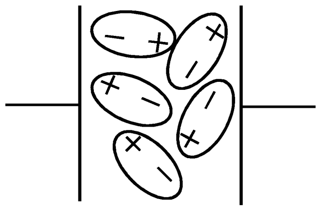
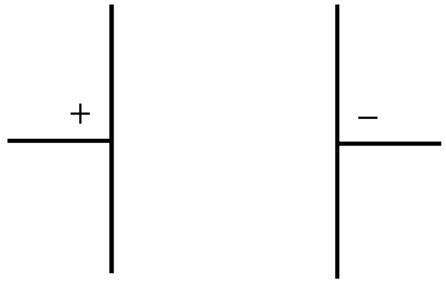
Topic 7.4: Capacitance

Oxford: pp. 110–111 Collins: pp. 112–113 Hodder: pp. 108–110

	Questions	Answers
7.4.1 Capacitance	**Fill in the gaps to describe a capacitor.**	**A capacitor is a device that stores _______________ when a ___________________________________ is set up across it. When the capacitor is placed into a circuit, this _______________.**
	Draw the circuit symbol for a capacitor.	
	Write an equation defining capacitance. **Label all of the variables and their units.**	
	A capacitor stores 12 μC when a potential difference of 8.2 V is across it. **Calculate the capacitance of the capacitor.**	
	Rearrange the equation for capacitance to find potential difference.	
	A capacitor has a capacitance of 49 nF and stores a charge of 940 nC. **Calculate the potential difference across the capacitor.**	

	Questions	Answers
7.4.2 Parallel plate capacitor	**Draw and label a diagram of a parallel plate capacitor.**	
	Write an equation for the capacitance of a parallel plate capacitor in terms of its dimensions. **Label all of the variables and constants and their units.**	
	Define 'dielectric constant' and 'relative permittivity'.	
	Write an equation for the capacitance of a parallel plate capacitor consisting of two conducting plates with a vacuum between them.	
	Rearrange the equation for the capacitance of a parallel plate capacitor to find the dielectric constant.	

7.4.2 Parallel plate capacitor (cont.)	Questions	Answers
	Use the equation for the capacitance of a parallel plate capacitor to show that the dielectric constant of a material is unitless.	
	Describe how you could use a parallel plate capacitor to determine the relative permittivity of a dielectric.	
	A parallel plate capacitor has plates with an area of 0.00040 m^2 which are 2.2 mm apart. **The dielectric constant of the dielectric between the plates is 52,000.** **Calculate the capacitance of the capacitor.**	
	A parallel plate capacitor has rectangular plates with a width of 1.9 cm and a length of 2.3 cm, which are 0.9 cm apart. **The capacitance of the capacitor is 65 nF. Calculate the dielectric constant of the dielectric in the capacitor.**	

	Questions	Answers
7.4.2 Parallel plate capacitor (cont.)	**A parallel plate capacitor has circular plates that are 1.82 cm apart.** **The dielectric constant of the dielectric in the capacitor is 245,000.** **The capacitance of the capacitor is 36.0 nF.** **Calculate the radius of the parallel plates.**	
	The diagram below shows a dielectric in a capacitor when no potential difference is applied across it.  **Complete the diagram opposite to show the dielectric when a potential difference is applied across the plates.**	
	Describe how the rearrangement of dielectric molecules in a capacitor increases the capacitance.	

