



# Topic Tests for A Level AQA Physics

Option 12: Turning Points in Physics

[zigzageducation.co.uk](http://zigzageducation.co.uk)

**POD  
6349**

Publish your own work... Write to a brief...  
Register at [publishmenow.co.uk](http://publishmenow.co.uk)

# Contents

Thank You for Choosing ZigZag Education.....	ii
Teacher Feedback Opportunity .....	iii
Terms and Conditions of Use .....	iv
Teacher’s Introduction .....	1
Write-on section .....	2
3.12.1 The Discovery of the Electron .....	2
3.12.2 (i) Wave–Particle Duality .....	4
3.12.2 (ii) Wave–Particle Duality .....	6
3.12.3 Special Relativity .....	8
Non-write-on section .....	11
3.12.1 The Discovery of the Electron .....	11
3.12.2 (i) Wave–Particle Duality .....	12
3.12.2 (ii) Wave–Particle Duality .....	13
3.12.3 Special Relativity .....	14
Answers .....	15

## Teacher's Introduction

These topic tests have been designed to help you and your students assess their knowledge of a topic after you have taught each part of **A Level AQA Physics Option 12: Turning Points in Physics** (specification for first teaching from September 2015).

Each topic test closely follows the content of the specification and includes:

- **Factual questions:** Some simpler factual questions are included to ensure that all the content and basics are covered, and to allow weaker learners access to some marks.
- **Short-answer questions:** These are not in exam style, and the purpose of these is to test different elements, knowledge and skills from the specification in a variety of styles.
- **Exam-style questions:** Where appropriate, topics may contain one or more exam-style questions, to prepare students for what they might meet in the exam, and to test exam skills.

Mathematical and practical skills are also covered in these topic tests.

Tests have been designed to take approximately 25–40 minutes and are worth on average between 20 and 35 marks. Please note that some tests have been split, as shown in the table:

Topic Number	Number of Marks
3.12.1	27
3.12.2 (i)	23
3.12.2 (ii)	20
3.12.3	36

The topic tests are suitable for a classroom assessment, revision aid or homework task and are, therefore, suitable for use immediately after a topic is completed in class or at the end of teaching the course.

Students are able to see the number of marks awarded for each question, allowing them to gauge the level of detail they will require for the answers, as in exam conditions. Full answers with marks are included at the end of the resource. Additionally, it makes the resource a suitable tool for students to use independently.

It is recommended that students have access to a calculator to complete the questions.

Students may also need a sheet containing Physics data and formulae, which can be found on the exam board website.

I hope you find these tests useful during your teaching.

### Free Updates!

Register your email address to receive any future free updates\* made to this resource or other Physics resources your school has purchased, and details of any promotions for your subject.

\* resulting from minor specification changes, suggestions from teachers and peer reviews, or occasional errors reported by customers

Go to [zzed.uk/freeupdates](https://zzed.uk/freeupdates)

### 3.12.2 (i) Wave-Particle Duality

1. a) What was the main difference between Newton's and Huygens' theories?

.....

.....

- b) Why did scientists at the time favour Newton's theory?

.....

.....

.....

- c) Explain how Young's Double Slits experiment subsequently suggested that light has a wave nature.

.....

.....

.....

.....

2. a) Describe the wave nature of light.

.....

.....

- b) i) State which fields are related to each constant:

permittivity of free space ( $\epsilon_0$ ) .....

permeability of free space ( $\mu_0$ ) .....

- ii) Show how the speed of light in a vacuum can be derived from these constants.

.....

.....

.....

- c) Describe how Hertz discovered radio waves.

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT  
PROTECTED



3. a) Describe how photoelectric emission is affected by:

i) frequency of incident light

.....

.....

ii) brightness of incident light

.....

.....

b) How did observations on photoelectric emission change our understanding of light?



.....

.....

.....

.....

.....

4. a) What was the 'ultraviolet catastrophe'?

.....

.....

.....

b) How did Planck interpret the 'ultraviolet catastrophe'?

.....

.....



INSPECTION COPY

**COPYRIGHT  
PROTECTED**



### 3.12.2 (i) Wave-Particle Duality

1.
  - a) What was the main difference between Newton's and Huygens' theories?
  - b) Why did scientists at the time favour Newton's theory?
  - c) Explain how Young's Double Slits experiment subsequently suggested the wave nature of light.
2.
  - a) Describe the wave nature of light.
  - b)
    - i) State which fields are related to each constant:  
permittivity of free space ( $\epsilon_0$ )  
permeability of free space ( $\mu_0$ )
    - ii) Show how the speed of light in a vacuum can be derived from these constants.
  - c) Describe how Hertz discovered radio waves.
3.
  - a) Describe how photoelectric emission is affected by:
    - i) frequency of incident light
    - ii) brightness of incident light
  - b) How did observations on photoelectric emission change our understanding of light?
4.
  - a) What was the 'ultraviolet catastrophe'?
  - b) How did Planck interpret the 'ultraviolet catastrophe'?

INSPECTION COPY

COPYRIGHT  
PROTECTED



## **Preview of Questions Ends Here**

---

This is a limited inspection copy. Sample of questions ends here to avoid students previewing questions before they are set. See contents page for details of the rest of the resource.

## Answers

### 3.12.1 The Discovery of the Electron

1. a) filament is heated ✓ causing electrons to be emitted ✓  
which are accelerated ✓ through a potential difference / towards an anode ✓
  - b)  $KE = 2000 \times 1.6 \times 10^{-19} \text{ J} = 3.2 \times 10^{-16} \text{ J}$  ✓  
 $3.2 \times 10^{-16} = \frac{1}{2} \times 9.11 \times 10^{-31} \times v^2$  ✓  
 $v = 2.7 \times 10^7 \text{ ms}^{-1}$  ✓
  - c)  $\frac{2000}{0.020} = \frac{F}{1.6 \times 10^{-19}}$  ✓  
 $F = 1.6 \times 10^{-14} \text{ N}$  ✓
2. a) it was quantised / only came in certain sized bits ✓ it was a particle ✓
  - b)  $\frac{1.6 \times 10^{-19}}{9.11 \times 10^{-31}} \text{ C kg}^{-1} = 1.8 \times 10^{11} \text{ C kg}^{-1}$  ✓
  - c)  $\frac{1.6 \times 10^{-19}}{1.1 \times 10^{-18}} \text{ C kg}^{-1} = 1.4 \times 10^7 \text{ C kg}^{-1}$  ✓
3. a)  $0.60 \times 1.6 \times 10^{-19} \times 100 = 9.6 \times 10^{-18} \text{ N}$  ✓
  - b)  $9.6 \times 10^{-18} = \frac{9.1 \times 10^{-31} \times 100^2}{r}$  ✓  
 $r = 9.5 \times 10^{-10} \text{ m}$  ✓
4. a)  $W = 6.5 \times 10^{-15} \times 9.8 = 6.4 \times 10^{-14} \text{ N}$  ✓  
 $\frac{4000}{0.030} = \frac{6.4 \times 10^{-14}}{Q}$  ✓  
 $Q = 4.8 \times 10^{-19} \text{ C}$  ✓
  - b)  $6.4 \times 10^{-14} = 6\pi \times 1.8 \times 10^{-5} \times r \times 1.0 \times 10^{-4}$  ✓  
 $r = \frac{6.4 \times 10^{-14}}{3.4 \times 10^{-8}}$  ✓  
 $r = 1.9 \times 10^{-6} \text{ m}$  ✓
  - c)  $\frac{m}{q} = \frac{6.5 \times 10^{-15}}{4.8 \times 10^{-19}}$  ✓  
 $\frac{m}{q} = 1.4 \times 10^4 \text{ kg C}^{-1}$  ✓
  - d) the charge was quantised ✓ so it was carried by particles ✓

INSPECTION COPY

COPYRIGHT  
PROTECTED





## **Preview of Answers Ends Here**

---

This is a limited inspection copy. Sample of answers ends here to stop students looking up answers to their assessments. See contents page for details of the rest of the resource.