AQA GCSE Physics | 8463

SPECIFICATION POINT 4.4.1.2

# Mass number, atomic number and isotopes

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **43** |
| Available paper years | **2004–2025** |

## Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

**Name:** _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 01 · Mark scheme** June 2004 | 3451F | Original Q5 | Legacy

The full source mark scheme begins on page 37. Follow original question 5 in that document.

**Answer 02 · Mark scheme** June 2004 | 3462F3 | Original Q5 | Legacy

The full source mark scheme begins on page 58. Follow original question 5 in that document.

**Answer 03 · Mark scheme** June 2005 | 3451 | Original Q7 | Legacy

The full source mark scheme begins on page 75. Follow original question 7 in that document.

**Answer 04 · Mark scheme** June 2005 | 3462 | Original Q7 | Legacy

The full source mark scheme begins on page 93. Follow original question 7 in that document.

**Answer 05 · Mark scheme** June 2006 | 3451 | Original Q4 | Legacy

The full source mark scheme begins on page 107. Follow original question 4 in that document.

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 06 · Mark scheme** June 2006 | 3462 | Original Q4 | Legacy

The full source mark scheme begins on page 127. Follow original question 4 in that document.

**Answer 07 · Mark scheme** November 2006 | PHY1B | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **3** | **2** | **4** | **4** |

**Answer 08 · Mark scheme** June 2007 | PHY1B | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | electron | **4** |
| | **B** | neutron | **3** |
| | **C** | nucleus | **2** |
| | **D** | proton | **1** |
| | | | |

**Answer 09 · Mark scheme** June 2007 | PHY1F | Original Q6 | Legacy

The full source mark scheme begins on page 141. Follow original question 6 in that document.

**Answer 10 · Mark scheme** November 2007 | PHY1B | Original Q4 | Legacy

| | | |
|---|---|---|
| Four | **A** | **1** |
| | **B** | **4** |
| | **C** | **3** |
| | **D** | **2** |
| | | |

**Answer 11 · Mark scheme** June 2008 | PHY1BP | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | electrons | **1** |
| | **B** | neutrons | **2** |
| | **C** | protons and electrons | **4** |
| | **D** | protons and neutrons | **3** |
| | | | |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 12 · Mark scheme**

June 2008 | PHY1BP | Original Q5 | Legacy

| | | | |
|---|---|---|---|
| Five | **A** | 4 | **4** |
| | **B** | 12 | **2** |
| | **C** | 60 | **1** |
| | **D** | 90 | **3** |

**Answer 13 · Mark scheme**

June 2008 | PHY1BP | Original Q9 | Legacy

| | | | | |
|---|---|---|---|---|
| Nine | **4** | **3** | **4** | **3** |

**GCSE**

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 14 · Mark scheme** June 2008 | PHY2F | Original Q6 | Legacy

**Question 6**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | protons<br>neutrons | answers may be in either order | 1<br>1 |
| (ii) | 86 | | 1 |
| (iii) | two **fewer** protons and two **fewer** neutrons<br>**or**<br>84 protons 134 neutrons | do **not** accept two fewer protons and neutrons<br>do **not** accept 218 protons and neutrons | 1 |
| (b)(i) | 0.4 | accept $\frac{2}{5}$ / accept 40%<br>for 2 marks<br>allow **1** mark for correct totalling = 1.8<br>allow **1** mark for a clearly correct method with a clearly incorrect total | 2 |
| (ii) | any **one** from:<br>• nuclear weapon testing<br>• nuclear power (stations)<br>• nuclear accidents<br>• medical | do **not** accept nuclear<br>accept nuclear/ radioactive waste<br>accept X-rays | 1 |
| (c)(i) | 2 | accept 2:1<br>accept twice as big<br>ignore units | 1 |

**Question 6 continues on the next page**

**PHY2F**

**June 08**

**Question 6 continued**

| | answers | extra information | mark |
|---|---|---|---|
| (ii) | No with a reasonable reason explained<br>only going for two weeks so<br>**or**<br>even staying for a year | | 1 |
| | total exposure well under lowest limit for causing cancer<br>**or** | **1** mark is for a time frame<br>**1** mark is for correctly relating to a dose | 1 |
| | Yes with a reasonable reason explained<br>all levels of radiation are (potentially) hazardous (1) | accept low doses could still cause cancer<br>accept all levels affect you<br>do **not** accept radiation dose is high(er)<br>do **not** accept level of background radiation is higher in Germany | |
| | harm caused by lower doses may not have been recorded (1)<br>**or**<br>evidence may not be complete<br>**or**<br>insufficient research into effect of small doses | | |
| total | | | 10 |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 15 · Mark scheme** November 2008 | PHY1BP | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | electrons | **3** |
| | **B** | neutrons | **4** |
| | **C** | nuclei | **2** |
| | **D** | protons | **1** |

**Answer 16 · Mark scheme** March 2009 | PHY1BP | Original Q4 | Legacy

| | | | |
|---|---|---|---|
| Four | **A** | electrons | **1** |
| | **B** | neutrons | **4** |
| | **C** | nuclei | **3** |
| | **D** | protons | **2** |

**Answer 17 · Mark scheme** March 2009 | PHY1BP | Original Q5 | Legacy

| | | | |
|---|---|---|---|
| Five | **A** | 3 | **4** |
| | **B** | 10 | **1** |
| | **C** | 12 | **2** |
| | **D** | 60 | **3** |

| | | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **D** |

**Answer 18 · Mark scheme** June 2009 | PHY1BP | Original Q6 | Legacy

| | | | | |
|---|---|---|---|---|
| Six | **2** | **2** | **1** | **2** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 19 · Mark scheme** June 2009 | PHY2F | Original Q7 | Legacy

**Question 7**

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>7(a)</td><td>
<table>
<tr><td>Particle</td><td>Relative Mass</td><td>Relative charge</td></tr>
<tr><td>Proton</td><td>1</td><td></td></tr>
<tr><td>Neutron</td><td></td><td>0</td></tr>
</table>
</td><td>accept one, accept +1<br>do not accept -1<br>accept zero<br>do not accept no charge/ nothing/ neutral unless given with 0</td><td>1<br><br>1</td></tr>
<tr><td>7(b)</td><td>equal numbers/amounts of protons and electrons<br><br>protons and electrons have equal but opposite charge</td><td><br><br>accept protons charge +1 and electron charge -1<br><br>accept (charge) on proton cancels/balances (charge) on electron<br>accept positive (charges) cancel out the negative(charges)<br>neutrons have no charge is neutral<br>do not accept total charge of protons, electrons (and neutrons) is 0 unless qualified</td><td>1<br><br>1</td></tr>
</table>

**Question 7 continues on the next page . . .**

4.4.1.2 Mass number, atomic number and isotopes

Answer 19 · Mark scheme



**PHY2F**

**Question 7 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **7**(c)(i) | (3) fewer neutrons | accept lower/ smaller mass number<br><br>do **not** accept different numbers of neutrons<br><br>any mention of fewer/more protons/ electrons negates mark<br><br>accept answers in terms of U-238 providing U-238 is specifically stated i.e. U-238 has (3) more neutrons | 1 |
| **7**(c)(ii) | neutron | | 1 |
| **7**(c)(iii) | (nuclear) fission | accept fision<br><br>do **not** accept any spelling that may be taken as fusion | 1 |
| **Total** | | | **7** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 19 · Mark scheme** June 2009 | PHY2F | Original Q7 | Legacy

**PHY2F**

**Answer 20 · Mark scheme** November 2009 | PHY1BP | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | count rate | **1** |
| | **B** | half-life | **3** |
| | **C** | penetrating power | **4** |
| | **D** | range | **2** |

**Answer 21 · Mark scheme** November 2009 | PHY1BP | Original Q4 | Legacy

| | | | |
|---|---|---|---|
| Four | **A** | contains 5 particles in its nucleus | **3** |
| | **B** | has a nucleus that is identical in structure to an alpha particle | **2** |
| | **C** | has the same number of electrons as atom 3 | **4** |
| | **D** | is a different isotope of hydrogen | **1** |

**Answer 22 · Mark scheme** November 2009 | PHY1BP | Original Q9 | Legacy

| | | | | |
|---|---|---|---|---|
| Nine | **2** | **1** | **2** | **3** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 23 · Mark scheme** January 2010 | PHY2F | Original Q4 | Legacy

**Question 4**

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>4(a)(i)</td><td>all correct<br><table><tr><td>Number of protons</td><td>3</td></tr><tr><td>Number of electrons</td><td>3</td></tr><tr><td>Number of neutrons</td><td>4</td></tr></table></td><td>accept presented as a tally chart<br><br>allow 1 mark for 1 correct</td><td>2</td></tr>
<tr><td>4(a)(ii)</td><td>7<br><br>number of protons and neutrons</td><td>reason may score even if 7 not chosen<br><br>accept number of particles in the nucleus<br>accept number of nucleons<br><br>do not accept number of electrons and neutrons</td><td>1<br><br>1</td></tr>
<tr><td>4(b)</td><td>an ion</td><td></td><td>1</td></tr>
<tr><td>4(c)(i)</td><td>smaller than</td><td></td><td>1</td></tr>
<tr><td>4(c)(ii)</td><td>radon loses an alpha (particle)<br>or<br>radon loses an (alpha) particle<br>or<br>(mass of) polonium plus an alpha = (mass) radon<br>or<br>radon loses 2 protons and 2 neutrons (to become polonium)</td><td>accept radon has less protons and neutrons</td><td>1</td></tr>
<tr><td>Total</td><td></td><td></td><td>7</td></tr>
</table>

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 23 · Mark scheme**

January 2010 | PHY2F | Original Q4 | Legacy

**PHY2F**

**Answer 24 · Mark scheme**

March 2010 | PHY1BP | Original Q2 | Legacy

| | | | |
|---|---|---|---|
| Two | **A** | gamma | **3** |
| | **B** | infra red | **4** |
| | **C** | radio | **1** |
| | **D** | ultraviolet | **2** |

**Answer 25 · Mark scheme**

March 2010 | PHY1BP | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | electron | **4** |
| | **B** | neutron | **2** |
| | **C** | nucleus | **3** |
| | **D** | proton | **1** |

**Answer 26 · Mark scheme**

June 2010 | PHY1BP | Original Q5 | Legacy

| | | | |
|---|---|---|---|
| Five | **A** | three | **3** |
| | **B** | four | **1** |
| | **C** | five | **2** |
| | **D** | eight | **4** |

| | | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **D** |

**Answer 27 · Mark scheme**

June 2010 | PHY1BP | Original Q9 | Legacy

| | | | | |
|---|---|---|---|---|
| Nine | 4 | 2 | 2 | 2 |

4.4.1.2 Mass number, atomic number and isotopes

Answer 28 · Mark scheme

June 2010 | PHY1F | Original Q7 | Legacy

## Question 7

| question | answers | extra information | mark |
|---|---|---|---|
| **7**(a) | gamma will pass through the body<br>**or**<br>alpha will not pass through the body | it refers to gamma<br><br>answers must relate to the body<br><br>accept skin for body | 1 |
| | gamma is only slightly ionising<br>**or**<br>alpha is heavily ionising | accept gamma causes less damage to cells / tissue<br><br>do **not** accept gamma causes no damage to cells<br><br>less harmful is insufficient | 1 |
| **7**(b)(i) | (both graphs show an initial) increase in count-rate | accept both show an increase | 1 |
| **7**(b)(ii) | only the right kidney is working correctly | | 1 |
| | any **two** from:<br>• count-rate / level / line for right kidney decreases (rapidly)<br>• count-rate / level / line for <u>left</u> kidney does not change<br>• radiation is being passed out / into urine - if referring to right kidney<br>• radiation is not being passed out - if referring to the left kidney | if incorrect box chosen maximum of **1** mark can be awarded<br><br>reference to named kidney can be inferred from the tick box<br><br>it decreases is insufficient<br><br>it does not change is insufficient | 2 |

**Question 7 continues on the next page . . .**

**PHY1F**

**Question 7 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **7**(c)(i) | time taken for number of nuclei to halve<br>**or**<br>time taken for the count-rate to halve | | 1 |
| **7**(c)(ii) | short half-life - the level of radiation (in the body) decreases rapidly<br><br>to a safe / very small level<br><br>**or**<br><br>a long half-life - the radiation remains in the body / for a long time<br><br>level of radiation remains high | it refers to short life isotope<br><br><br><br><br><br>answers in terms of damage eg cancer are insufficient | 1<br><br><br>1 |
| **Total** | | | **9** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 29 · Mark scheme**

November 2010 | PHY1BP | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **1** | **3** | **3** | **1** |

**Answer 30 · Mark scheme**

November 2010 | PHY1BP | Original Q9 | Legacy

| | | | | |
|---|---|---|---|---|
| Nine | **2** | **1** | **3** | **3** |

**Answer 31 · Mark scheme**

March 2011 | PHY1BP | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | bacteria | **3** |
| | **B** | cells | **2** |
| | **C** | isotopes | **1** |
| | **D** | particles | **4** |

**Answer 32 · Mark scheme**

June 2011 | PHY1BP | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **3** | **1** | **2** | **4** |

4.4.1.2 Mass number, atomic number and isotopes

Answer 33 · Mark scheme

June 2011 | PHY1F | Original Q8 | Legacy

## Question 8

| question | answers | extra information | mark |
|---|---|---|---|
| **8**(a)(i) | decommissioning | | 1 |
| **8**(a)(ii) | level of radiation **or** radiation dose (to workers) decreased | accept the isotope / cobalt(-60) has decayed (a lot)<br><br>accept the isotope / cobalt(-60) has decayed in 2 half lives<br><br>accept exposed to less radiation<br><br>do **not** accept no radiation left | 1 |
| | less hazardous / dangerous (to workers health) | accept safer<br><br>do **not** accept there is no hazard<br><br>accept allows reactor to cool (down)<br><br>an answer of radiation levels decrease by 75 % or drops to 25 % gains **2** marks | 1 |
| **8**(b)(i) | more in favour<br>**or**<br>fewer against | quoting figures alone is insufficient<br><br>do **not** accept it increases<br><br>ignore any reasons given | 1 |

**Question 8 continues on the next page**

4.4.1.2 Mass number, atomic number and isotopes



**PHY1F**

**Question 8 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **8**(b)(ii) | any **one** from:<br>• sample too small<br>• do not know how many (people) were asked<br>• different people asked (in different years)<br>• sample not representative (of population)<br>• people did not understand the questions<br>• do not know who carried out the surveys<br>• do not know if surveys asked same questions | do **not** accept they are biased unless acceptable reason for bias given | 1 |

**Question 8 continues on the next page**

**PHY1F**

**Question 8 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **8**(b)(iii) | any **one** from:<br>• no / less pollutant gases produced<br>• reliable source (of energy / electricity)<br>• running out of fossil fuels<br>• conserve fossil fuels<br>• meet increasing demand<br>• less reliance on imported fossil fuels / electricity<br>• concentrated energy source(s)<br>• lower transportation costs for fuel<br>• to replace old <u>nuclear</u> power stations | accept a named gas<br>accept does not contribute to global warming<br>accept a named fossil fuel<br>accept fossil fuels won't have to be used<br>accept named fossil fuel<br>ignore references to efficiency / job creation / local economy / selling electricity | 1 |
| **8**(c) | economic issues | | 1 |
| **Total** | | | **7** |

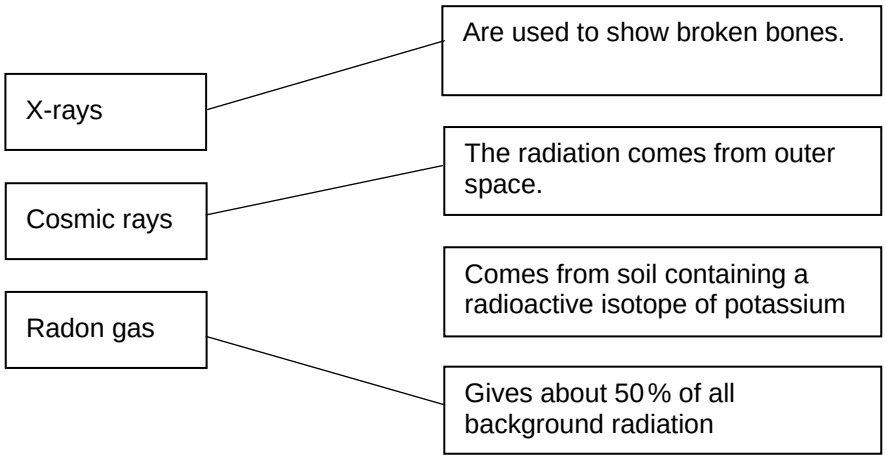
### 4.4.1.2 Mass number, atomic number and isotopes

Answer 34 · Mark scheme

June 2011 | PHY2F | Original Q1 | Legacy

## Question 1

| question | answers | extra information | mark |
|---|---|---|---|
| 1 | **1** mark for each correct line | If more than 1 line has been drawn from a box in **List A** then all those lines are marked incorrect. | 3 |




| Total | | | 3 |
|---|---|---|---|

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 34 · Mark scheme** June 2011 | PHY2F | Original Q1 | Legacy

**PHY2F**

4.4.1.2 Mass number, atomic number and isotopes

Answer 35 · Mark scheme

June 2011 | PHY2F | Original Q2 | Legacy

## Question 2

| question | answers | extra information | mark |
|---|---|---|---|
| **2(a)** | proton<br>electron<br>neutron | all 3 in correct order<br><br>allow **1** mark for 1 correct<br><br>do **not** accept letters p, e, n | 2 |
| **2(b)** | 4<br><br>number of protons | reason only scores if 4 is chosen<br><br>accept number of electrons<br><br>accept there are 4 protons and 4 electrons<br><br>do **not** accept there are 4 protons and electrons | 1<br><br>1 |
| **2(c)** | The atom loses an electron. | | 1 |
| **Total** | | | **5** |

### 4.4.1.2 Mass number, atomic number and isotopes

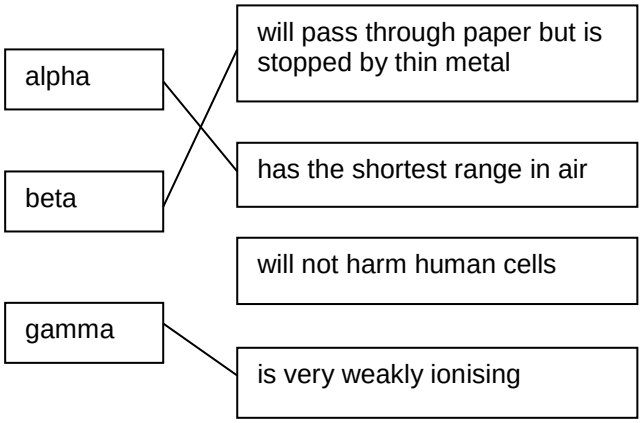
**Answer 35 · Mark scheme** June 2011 | PHY2F | Original Q2 | Legacy

**PHY2F**

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 36 · Mark scheme** June 2013 | PH2FP | Original Q1 | Legacy

## Question 1

| question | answers | extra information | mark |
|---|---|---|---|
| **1(a)** | 3 lines correct<br><br> | allow **1** mark for each correct line<br><br>if more than one line is drawn from any type of radiation box then all of those lines are wrong | 3 |
| **1(b)** | Gamma radiation will pass through the body | | 1 |
| **1(c)** | half | | 1 |
| **1(d)** | protons | | 1 |
| **Total** | | | **6** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 36 · Mark scheme** June 2013 | PH2FP | Original Q1 | Legacy

**PH2FP**

**Answer 37 · Mark scheme** June 2014 | PH2FP | Original Q5 | Legacy

| | | | | |
|---|---|---|---|---|
| **5(a)(i)** | neutron | | 1 | AO1<br>2.5.1a, b |
| **5(a)(ii)** | neutron<br>proton | both required, either order | 1 | AO1<br>2.5.1b |
| **5(a)(iii)** | 2<br>number of <u>protons</u> | <br>do not accept number of electrons | 1<br>1 | AO1<br>2.5.1e |
| **5(b)(i)** | any **one** from:<br>• beta<br>• gamma | accept correct symbols<br>accept positron / neutrino / neutron<br>cosmic rays is insufficient | 1 | AO1<br>2.5.2 |
| **5(b)(ii)** | electrons | | 1 | AO1<br>2.5.2c |
| **5(b)(iii)** | are highly ionising | | 1 | AO1<br>2.5.2e |
| **5(c)(i)** | mutate / destroy / kill / damage / change / ionise | Harm is insufficient | 1 | AO3<br>2.5 |
| **5(c)(ii)** | much smaller than | | 1 | AO3<br>2.5 |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 37 · Mark scheme**

June 2014 | PH2FP | Original Q5 | Legacy

| | | | | |
|---|---|---|---|---|
| **Total** | | | **9** | |
| **Question** | **Answers** | **Extra information** | **Mark** | **AO spec ref** |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 38 · Mark scheme** June 2016 | PH2FP | Original Q4 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **4(a)** | neutrons | | 1 | AO1 2.5.1e |
| **4(b)** | generate electricity | accept produce electricity<br>accept heat water<br>accept produce steam<br>turns turbines is insufficient | 1 | AO1 2.6 |
| **4(c)(i)** | a neutron | | 1 | AO1 2.6.1c |
| **4(c)(ii)** | two particles **X** released from the uranium-235<br><br>uranium-235 shown splitting into two fragments<br><br>**or**<br><br>each particle **X** shown colliding with a uranium-235 and producing 2 further particles **X** | <br><br>one uranium-235 shown splitting is sufficient, provided no contradiction shown | 1<br><br>1 | AO1 2.6.1e |
| **Total** | | | **5** | |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 38 · Mark scheme**

June 2016 | PH2FP | Original Q4 | Legacy



### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 39 · Mark scheme**

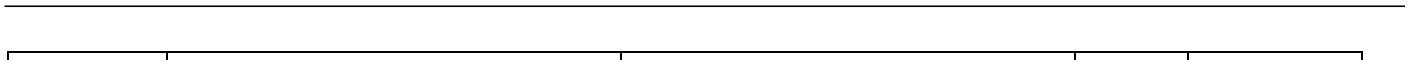


| Question | Answers | | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | B | reason only scores if B is chosen | 1 | AO1 4.4.1.2 |
| | americium has an atomic number of 95 | allow proton number for atomic number<br><br>allow B has a different atomic number<br><br>allow B has an atomic number of 94 | 1 | AO3 4.4.1.2 |
| **05.2** | 430 (years) | allow an answer between 420 and 440 (years) | 1 | AO2 4.4.2.3 |
| **05.3** | 430 (years)<br>**or**<br>their answer to question **05.2** | allow an answer between 420 and 440 (years) | 1 | AO1 4.4.2.3 |
| **Total** | | | **4** | |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 39 · Mark scheme**

June 2018 | 8463/1F | Original Q5



4.4.1.2 Mass number, atomic number and isotopes

Answer 40 · Mark scheme

November 2021 | 8463/1F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | atomic number | | 1 | AO1<br>4.4.1.2 |
| **05.2** | number of neutrons | | 1 | AO1<br>4.4.1.2 |
| **05.3** | Alpha | | 1 | AO3<br>4.4.2.2<br>4.4.2.1 |
| **05.4** | Beta | | 1 | AO3<br>4.4.2.2 |
| **05.5** | decrease<br><br>increase | this order only | 1<br><br>1 | AO3<br><br>AO1<br><br>4.4.2.1 |
| **05.6** | the time it takes for the count rate of a sample to halve | | 1 | AO1<br>4.4.2.3 |
| **05.7** | so the activity of the source is approximately constant | | 1 | AO3<br>4.4.2.3 |
| **Total** | | | **8** | |

4.4.1.2 Mass number, atomic number and isotopes

Answer 41 · Mark scheme

June 2022 | 8463/1F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | 2 protons and 2 neutrons | | 1 | AO1 4.4.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | an electron | | 1 | AO1 4.4.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | $^{85}_{36}Kr \longrightarrow {}^{85}_{37}Rb + {}^{0}_{-1}e$ | | 1 | AO1 4.4.2.2 |

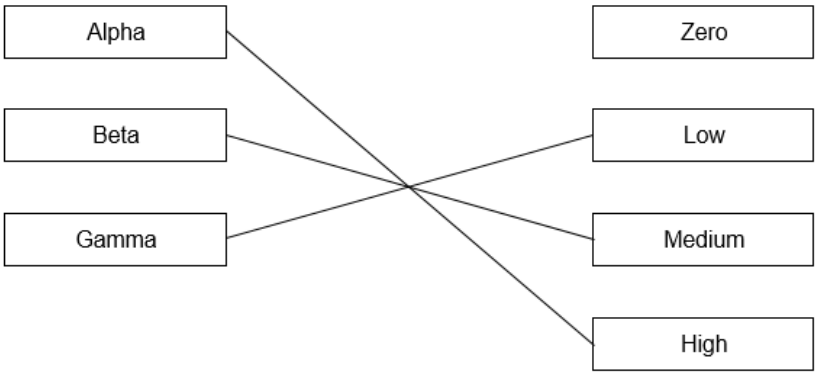
| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.4 | | | 3 | AO1 4.4.2.1 |

| Type of radiation | Most radiation is stopped by: | | |
|---|---|---|---|
| | the sheet of paper | the sheet of aluminium | the block of lead |
| Alpha | Yes | Yes | Yes |
| Beta | No | Yes | Yes |
| Gamma | No | No | Yes |

**1** mark for each correct row
allow ticks and crosses in place of yes and no
any incorrect answer on a row negates the mark for the row

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 41 · Mark scheme** June 2022 | 8463/1F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.5** | <br>**1** mark for each correct line<br>if more than one line drawn from radiation type list principle applies | | 1<br>1<br>1 | AO1<br>4.4.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.6** | nuclear accidents | | 1 | AO1<br>4.4.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.7** | number = $\frac{2.0}{0.005}$<br>number = 400 | | 1<br>1 | AO2<br>4.4.3.1 |

| | | |
|---|---|---|
| **Total Question 4** | | **12** |

4.4.1.2 Mass number, atomic number and isotopes

Answer 42 · Mark scheme

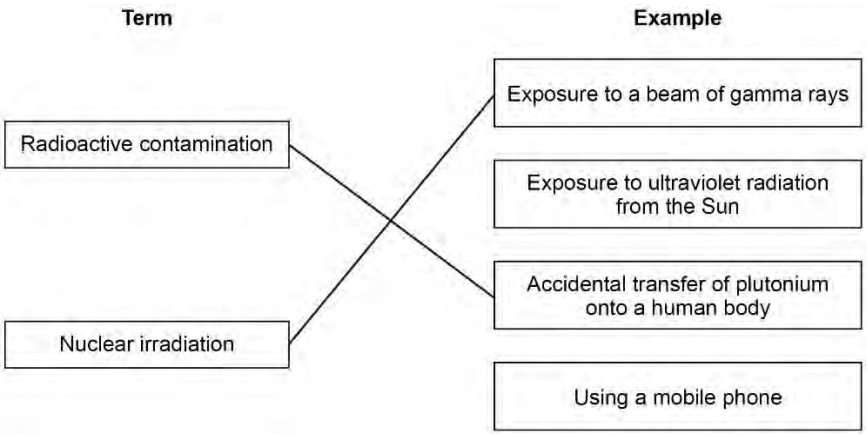
June 2023 | 8463/1F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.1 | protons<br><br>neutrons | this order only | 1<br><br>1 | AO1<br>4.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.2 | the time taken for half the nuclei in a sample to decay | | 1 | AO1<br>4.4.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.3 | carbon-18 | | 1 | AO3<br>4.4.2.3 |

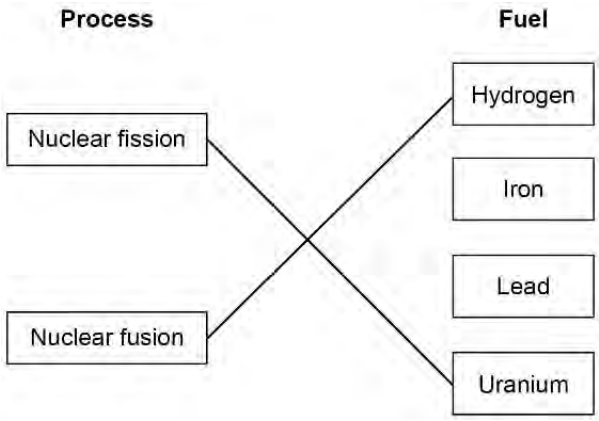
| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 03.4 | <br>1 mark for each correct line<br><br>additional line from a box on the left negates the mark for that box | 1<br><br>1 | AO1<br>4.4.2.4 |

### 4.4.1.2 Mass number, atomic number and isotopes

**Answer 42 · Mark scheme** June 2023 | 8463/1F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.5** | to remove radioactive dust from their shoes | | 1 | AO3 4.4.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.6** | number of days = $\frac{0.072}{0.00050}$<br><br>number of days = 144 | | 1<br><br>1 | AO2 4.4.3.1 |

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| **03.7** | <br>1 mark for each correct line<br><br>additional line from a box on the left negates the mark for that box | 1<br><br>1 | AO1 4.4.4.1 4.4.4.2 |

| Total Question 3 | 11 |
|---|---|

4.4.1.2 Mass number, atomic number and isotopes

Answer 43 · Mark scheme

June 2025 | 8463/1F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | $^{230}_{92}U \rightarrow {}^{226}_{90}Th + {}^{4}_{2}He$ | | 1 | AO1<br>4.4.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.2** | 20 (days) | | 1 | AO3<br>4.4.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.3** | 20 (days) | allow ecf from question **03.2** | 1 | AO1<br>4.4.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.4** | isotope **A**<br><br>shortest half-life<br><br>**or**<br>decays quickest<br><br>**or**<br>graph is steepest (initially)<br><br>**or**<br>smallest percentage of atoms left (at any time after t = 0) | <br><br>MP2 dependent on MP1 | 1<br><br>1 | AO3<br>4.4.2.1<br>4.4.2.3 |

4.4.1.2 Mass number, atomic number and isotopes

Answer 43 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.5 | A | | 1 | AO3<br>4.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.6 | D | | 1 | AO3<br>4.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.7 | **B** and **C**<br><br>same number of protons (and different number of neutrons) | <br><br>MP2 dependent on MP1<br>allow same atomic number<br>ignore electrons | 1<br><br>1 | AO3<br><br>AO1<br><br>4.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.8 | plum pudding model | | 1 | AO1<br>4.4.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.9 | the mass of the atom is concentrated in the nucleus | | 1 | AO1<br>4.4.1.3 |

| Total Question 3 | 11 |
|---|---|

# GCSE 2004
*June Series*

ASSESSMENT and QUALIFICATIONS ALLIANCE

# Mark Scheme

## Physics Specification B
*3451/F*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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### 4.4.1.2 Mass number, atomic number and isotopes



Further copies of this Mark Scheme are available from:

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## 4.4.1.2 Mass number, atomic number and isotopes





# GCSE PHYSICS

# INFORMATION FOR EXAMINERS

**1. General**

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

**2. Emboldening**

**2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

**2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.

**2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

**3. Marking points**

**3.1 Marking of Quality of Written Communication**

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

**3.2 Marking of lists**

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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## 4.4.1.2 Mass number, atomic number and isotopes





Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | 4,8 | 0 |
| 2 | green, 5 | 0 |
| 3 | red*, 5 | 1 |
| 4 | red*, 8 | 0 |

Example 2: Name two planets in the solar system. (2 marks)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | Pluto, Mars, Moon | 1 |
| 2 | Pluto, Sun, Mars, Moon | 0 |

**3.3 Use of chemical symbols/formulae**

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

**3.4 The marking of quantitative relationships**

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

**3.5 Marking procedure for calculations**

**3.5.1** Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

**3.5.2** Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

**3.6 Interpretation of 'it'**

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.



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## 4.4.1.2 Mass number, atomic number and isotopes





**3.7 Errors carried forward**

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

**3.8 Phonetic spelling**

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

**3.9 Brackets**

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

**3.10 Interpretation of marginal points**

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

**3.11 Unexpected Correct Answers not in the Mark Scheme**

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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## 4.4.1.2 Mass number, atomic number and isotopes





**GCSE Physics**
**Foundation Tier 3451/F**

**3451F Q1**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | comet | correct order only | 1 |
| | elliptical | | 1 |
| | Milky Way | | 1 |
| | Universe | | 1 |
| (b)(i) | D A C B | allow **2** marks for two letters in the correct place<br>allow **1** mark for one letter in the correct place | 3 |
| (ii) | A | | 1 |
| total | | | 8 |



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### 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 95 | | 1 |
| (b) | alpha | accept correct symbol | 1 |
| (c) | any **two** from:<br>• radiation is outside the body<br>• radiation will not reach (living) cells<br>• radiation absorbed by the air | <br>accept detector is on ceiling or high up the wall<br>accept radiation cannot pass through the body / skin<br>accept cannot pass through the plastic casing<br>do **not** accept because it is alpha radiation – unless qualified<br>do **not** accept does not give off harmful substance<br>do **not** accept cannot pass through building materials etc. | 2 |
| (d) | less (than) | | 1 |
| total | | | 5 |

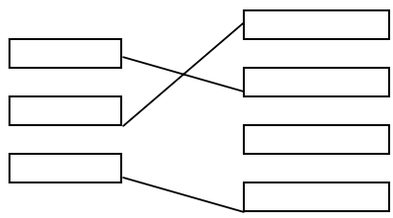
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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | generator | accept dynamo<br>accept alternator | 1 |
| (b)(i) | 1400 | ignore units | 1 |
| (ii) | 0.3 or 30% | any incorrect unit penalise **1** mark<br>allow **1** mark for the correct use of 600 **or** 0.3% **or** 30 | 2 |
| (c) | **1** mark for each correct link<br> | if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect | 3 |
| (d)(i) | 110 | no tolerance | 1 |
| (ii) | 12 | no tolerance | 1 |
| (iii) | wind speed may be too low to operate the generator | accept wind may not always blow<br>accept power depends on wind speed<br>accept does not generate if wind speed is too high<br>accept does not generate if wind speed is above 12 (m/s)<br>accept does not generate if wind speed is below 1.6 (m/s)<br>accept it is unreliable<br>do **not** accept answers referring to cost only | 1 |
| total | | | 10 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | B E A D | allow **1** mark for each letter in the correct place, to a maximum of **3** marks | 3 |
| (b) | (a spark) may cause the (petrol vapour) to explode / ignite | accept petrol for (petrol vapour)<br>accept catch fire for explode | 1 |
| | connect tanker to earth with a (conducting) wire / chain **or** earth the tanker | accept ground for earth | 1 |
| (c) | **Quality of written communication** | for a logical sequence | 1 |
| | any **two** from: | | 2 |
| | • when current greater than fuse rating / value | accept when current too great for appliance<br>do **not** accept 'if there is too much current'<br>do **not** accept voltage or electricity | |
| | • fuse (becomes hot and) melts / burns out | accept fuse blows / breaks | |
| | • circuit is broken | accept circuit switched off<br>this cannot score credit on its own | |
| total | | | 8 |

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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | crust | | 1 |
| (ii) | inner core is <u>solid</u><br><br>outer core is liquid | do **not** accept just rock<br><br>inner core is denser / hotter than outer core gets **2** marks<br>accept one is solid and one is liquid for **1** mark<br>accept they are different densities for **1** mark<br>wrong way round = **0** marks | 1<br><br>1 |
| (b) | seismograph | | 1 |
| (c) | difficult to measure (slow) movement (1)<br>of plates (1) dependent mark<br>**or**<br>difficult to measure friction / forces (1)<br>between plates (1) dependent mark | | 1<br><br>1 |
| (d) | geothermal | | 1 |
| (e)(i) | 5000 | | 1 |
| (ii) | 2500 | | 1 |
| total | | | 9 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q6**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | converging<br>image<br>object<br>image<br>object<br>shorter | | 1<br>1<br>1<br>1<br>1<br>1 |
| (b)(i) | (Earth's) gravity | accept centripetal<br>accept minor misspellings, however, do **not** credit any response which could be 'centrifugal' | 1 |
| (ii) | to(wards) (the centre of the) Earth | allow inwards<br>do **not** accept downwards | 1 |
| (c)(i) | **either**<br><br>friction (force)<br>**or** centripetal force<br><br>between the tyres / wheels and (the surface of) the road | <br><br>allow grip<br><br>allow on the tyres / wheels<br>**or** towards the centre of the bend / arc / circle | <br><br>1<br><br>1 |
| (ii) | mass<br>**or** speed<br>**or** momentum<br><br>radius / diameter | allow weight<br>allow velocity<br><br>do **not** credit 'curvature' or 'circumference' | 1<br><br>1 |
| (d) | centripetal | accept minor misspellings (see above) | 1 |
| total | | | 13 |

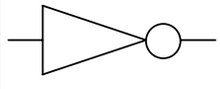
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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q7**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | two switches in series **and** circuit complete | ignore small imperfections | 1 |
| (ii) | two switches in parallel **and** circuit complete | ignore small imperfections | 1 |
| (iii) | one switch in parallel with the cell / lamp (but **not** both) | ignore small imperfections | 1 |
| (iv) | (i) AND<br>(ii) OR<br>(iii) NOT | accept 'and'<br>accept 'or'<br>accept 'not' | 1<br>1<br>1 |
| (b)(i) | when it is light the sensor sends on / high / 1 signal to the gate<br>off / low / 0 sent to the lamp<br>**or**<br>when it is dark the sensor sends off / low / 0 signal to the gate (1)<br>on / high / 1 sent to the lamp (1) | | 1<br>1 |
| (ii) | any suitable application | e.g. to switch a security light on (and off)<br>e.g. to switch a light on when it is dark<br>do **not** credit just '… to switch a light on / off' | 1 |
| (c)(i) |  | accept shading-in of either or both parts<br>end connections are not required<br>accept any orientation | 1 |
| (ii) | 1 0 **or** 0 1<br>0 1 1 0 | all correct | 1 |
| (iii) | truth (table) | | 1 |
| total | | | 12 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q8**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 60 | | 1 |
| (b) | $5\frac{1}{2}$ hours | must include unit | 1 |
| (c) | 30 | | 1 |
| (d) | 30 minutes<br>or $\frac{1}{2}$ hour | must include unit | 1 |
| (e) | D **and** E<br><br>least steep part of the graph | accept finish for E<br>accept correct numbers from axes with units<br><br>accept covers smallest distance in a set time<br>accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6)<br><br>ignore horse is tired | 1<br><br>1 |
| total | | | 6 |

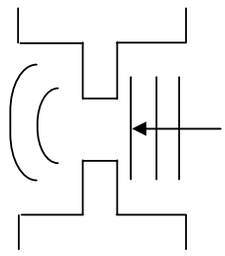
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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | any **one** from:<br>• (doctors) to see inside a patients body **or** endoscope<br>• telephone cables<br>• optical fibre / fibre optic lamps **or** (artificial) Christmas trees<br>• data transfer **or** internet connection | <br>accept keyhole surgery<br>do **not** accept flex **or** wires for cable<br>accept decorative / ornamental lighting<br>accept any feasible practical suggestion for taking light to a difficult to access place<br>do **not** accept lighting unqualified<br>do **not** accept lamp unqualified<br>do **not** accept communications unless clarified | 1 |
| (ii) | (incident) ray angle greater than critical angle<br>total internal reflection occurs | either order<br>accept (incident) ray greater than 42°<br>accept TIR<br>do **not** accept just description of TIR | 1<br>1 |
| (b)(i) | waves shown diffracting in the correct direction<br> | ignore wavelength | 1 |
| (ii) | diffraction | accept diffract / diffracted | 1 |
| total | | | 5 |



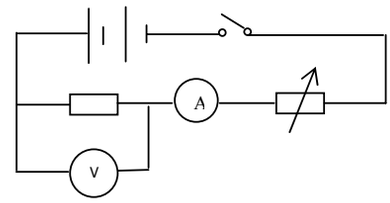
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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q10**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | all symbols correct | <br>accept push switch symbol<br>switch may be open or closed<br>any lines through symbols = **0** marks | 1 |
| | correct circuit drawn<br><br>voltmeter must be across resistor only | polarity of cells not relevant provided they are joined correctly<br>two cells are required in the diagram<br>ignore the order of the components<br>allow small gaps in circuit<br><br>omission of any component = **0** marks | 1 |
| (b)(i) | potential difference<br>= current × resistance | accept voltage or p.d. for potential difference<br><br>accept $V = I \times R$<br><br>accept  provided<br>subsequent use correct<br><br>do **not** accept C for current | 1 |
| (ii) | 2 | <br>allow **1** mark for correct substitution<br>wrong working loses both marks | 2 |
| (iii) | straight line drawn <u>through the origin</u><br><br>straight line passes through<br>$I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0 | judge by eye<br><br>this mark may be awarded if all points shown including these points are correct even if no line is drawn<br>N.B. a curve scores **0** marks | 1<br><br>1 dep |
| (c) | temperature <u>increases</u> | accept filament lamp / it gets <u>hotter</u><br>allow heat for temperature | 1 |
| total | | | 8 |

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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | gamma rays | accept gamma<br>accept correct symbol | 1 |
| (ii) | infra red | accept IR | 1 |
| (b) | ultraviolet <u>absorbed</u> by ink<br><br>(energy) given out as light | <br><br>accept glows / luminous<br>accept for **both** marks the ink is fluorescent<br>do **not** accept answers in terms of uv being reflected | 1<br><br>1 |
| (c) | any **two** from:<br><br>• UV can damage / kill / ionise / alter (normal) cells<br><br>• change DNA structure **or** mutate<br><br>• (normal) cells may become cancerous | <br><br>do **not** accept attacks cells **or** burns skin<br><br><br><br>accept may cause (skin) cancer<br>accept abnormal cell multiplication | 2 |
| (d)(i) | microwaves **and** infra red | both answers needed in either order<br><br>do **not** accept heat for IR | 1 |
| (ii) | 0.9 | <br><br>allow **1** mark for the <u>correct</u> use of<br>1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$<br>i.e. adding the correct 2 power values | 2 |
| total | | | 9 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | accelerating | accept getting faster<br>accept speed / velocity increasing | 1 |
| (ii) | acceleration increases | accept velocity / speed increases more rapidly<br>do **not** accept velocity / speed increases | 1 |
| (b)(i) | $\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$ | accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$<br>do **not** accept velocity for change in velocity<br>do **not** accept change in speed<br>do **not** accept $a = \frac{v}{t}$ | 1 |
| (ii) | 15 | allow **1** mark for an answer of 900 **or** for correct use of 540 seconds | 2 |
| (iii) | velocity includes direction | accept velocity is a vector (quantity)<br>accept converse answer | 1 |
| (c) | force of gravity (between shuttle and Earth)<br>plus correct orbital speed (makes shuttle move in a curve) | accept gravitational pull if used correctly<br>accept forward motion **or** constant speed for orbital speed<br>accept it is travelling fast enough<br>accept for **2** marks the force of gravity provides the centripetal force | 1<br>1 |
| (d) | black is a good emitter of radiation<br>**or** to limit the temperature rise inside the shuttle | accept heat for radiation<br>accept the tiles are good insulation<br>do **not** accept black absorbs heat on its own<br>do **not** accept tiles are heat proof | 1 |
| total | | | 9 |

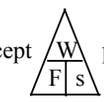
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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q13**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | work (done)<br>= force (applied) × distance (moved) | accept W = F × s or W = F × d<br><br>accept  provided<br><br>subsequent method is correct | 1 |
| (ii) | 240 000<br><br>joules | allow **1** mark for correct substitution **or** correct use of 1200 (N)<br><br>accept J<br>do **not** accept j / Nm | 2<br><br>1 |
| (b) | 800 (watts) | accept 0.8 kW<br>accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks<br><br>allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark | 2 |
| (c)(i) | any **one** from:<br>• needs to raise the chair / lift<br>• lifting more than one chair<br>• energy transfer to the surroundings correctly qualified | <br><br>allow lifting more than 2 people implication of a heavier weight<br><br>accept loss for transfer<br>do **not** accept motor inefficient<br>do **not** accept motor gets hot<br>do **not** accept friction unless the location is specified as external to the motor | 1 |
| (ii) | electrical<br><br>potential | accept electric<br><br>**both** answers required for the mark | 1 |
| total | | | 8 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q14**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | current | | 1 |
| (ii) | resistance<br><br>decreases | <br><br>accept 'the flow of electrons / current (through it) increases' for **1** mark<br><br>do **not** credit just '… it will get warmer' | 1<br><br>1 |
| (b) | input sensor → controlled by the processor<br>processor → detects changes in the environment<br>output device → decides what action is needed | all pairs correct<br><br>one pair correct for **1** mark | 2 |
| (c)(i) | potential divider | accept voltage divider | 1 |
| (ii) | 4 (volts) | $6 \times \frac{30}{45}$ for **1** mark | 2 |
| (iii) | across the new resistor…(will) increase<br><br>across $R_2$ … (will) decrease | <br><br>N.B. independent marks | 1<br><br>1 |
| total | | | 10 |

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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q15**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | relay (normally open) (switch) | each mark is independent | 1 |
| | … switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit | do **not** accept switch on another circuit **or** smaller / equal current | 1 |
| | light emitting diode / LED | do **not** credit LDR | 1 |
| | … in one / direct / certain direction **or** from left to right | **or** when the cathode is connected to the negative terminal / side<br>**or** when the left-hand side is connected to the positive terminal / side<br>do **not** credit just '… is big enough'<br>do **not** accept 'positive direction' | 1 |
| | AND gate | accept 'and' gate | 1 |
| | … (both) inputs are on / high / 1 **or** current flows in both inputs | do **not** accept numerical values unless expanded | 1 |
| (b) | **Quality of written communication** | If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points<br>Q ✓ Q X | 1 |
| | any **three** from:<br>• advantage of mobile phones<br>• drawback of mobile phones<br>• benefit of the Internet<br>• drawback of the Internet | e.g. more convenient for service engineers<br>e.g. calls can be received away from base<br>e.g. privacy can be more easily invaded<br>e.g. drivers can be distracted<br>e.g. microwaves / radio waves can / may cause damage to the brain<br>e.g. access to educational material<br>e.g. some material is salacious<br>e.g. spam (on external e-mail)<br>these are examples<br>candidates may be credited for a variety of responses | 3 |
| total | | | 10 |



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## 4.4.1.2 Mass number, atomic number and isotopes





**3451F Q16**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | **Y** and **Z** | | 1 |
| | they have the same number of protons **or** same atomic number | accept they have the same number of electrons **or** same number of protons **and** electrons<br>allow only different in number of neutrons<br>N.B. independent marks | 1 |
| (b) | **Quality of written communication** | for correct use of terms underlined in B **or** C<br><br>Q ✓ Q X | 1 |
| | A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus<br><br>B – alpha particle deflected / repelled / repulsed by the (positive) nucleus<br><br>C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards | describes 3 tracks correctly for **2** marks<br>describes 2 or 1 track correctly for **1** mark<br><br>do **not** accept hits the nucleus<br>do **not** accept answers referring to refraction<br>do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion<br><br>mention of difference in charge on nucleus negates that track | max 2 |
| total | | | 5 |

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GCSE 2004
*June Series*

ASSESSMENT and QUALIFICATIONS ALLIANCE

# Mark Scheme

## Science: Double Award

## Specification B (Co-ordinated)

*3462/3F*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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### 4.4.1.2 Mass number, atomic number and isotopes



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## 4.4.1.2 Mass number, atomic number and isotopes





# SCIENCE: DOUBLE AWARD CO-ORDINATED

# INFORMATION FOR EXAMINERS

**1. General**

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

**2. Emboldening**

**2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

**2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.

**2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

**3. Marking points**

**3.1 Marking of Quality of Written Communication**

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

**3.2 Marking of lists**

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | 4,8 | 0 |
| 2 | green, 5 | 0 |
| 3 | red*, 5 | 1 |
| 4 | red*, 8 | 0 |

Example 2: Name two planets in the solar system. (2 marks)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | Pluto, Mars, Moon | 1 |
| 2 | Pluto, Sun, Mars, Moon | 0 |

**3.3 Use of chemical symbols/formulae**

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

**3.4 The marking of quantitative relationships**

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

**3.5 Marking procedure for calculations**

**3.5.1** Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

**3.5.2** Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

**3.6 Interpretation of 'it'**

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.


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## 4.4.1.2 Mass number, atomic number and isotopes





**3.7 Errors carried forward**

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

**3.8 Phonetic spelling**

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

**3.9 Brackets**

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

**3.10 Interpretation of marginal points**

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

**3.11 Unexpected Correct Answers not in the Mark Scheme**

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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## 4.4.1.2 Mass number, atomic number and isotopes





**Double Award**
**Foundation Tier 3462/3F**

**3462/3F Q1**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | comet | correct order only | 1 |
| | elliptical | | 1 |
| | Milky Way | | 1 |
| | Universe | | 1 |
| (b)(i) | D A C B | allow **2** marks for two letters in the correct place<br>allow **1** mark for one letter in the correct place | 3 |
| (ii) | A | | 1 |
| total | | | 8 |


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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 95 | | 1 |
| (b) | alpha | accept correct symbol | 1 |
| (c) | any **two** from:<br>• radiation is outside the body<br>• radiation will not reach (living) cells<br>• radiation absorbed by the air | <br>accept detector is on ceiling or high up the wall<br>accept radiation cannot pass through the body / skin<br>accept cannot pass through the plastic casing<br>do **not** accept because it is alpha radiation – unless qualified<br>do **not** accept does not give off harmful substance<br>do **not** accept cannot pass through building materials etc. | 2 |
| (d) | less (than) | | 1 |
| total | | | 5 |

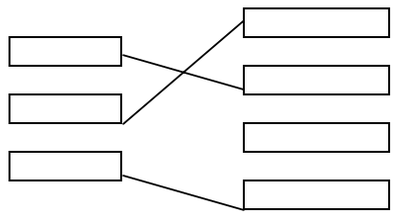
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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | generator | accept dynamo<br>accept alternator | 1 |
| (b)(i) | 1400 | ignore units | 1 |
| (ii) | 0.3 or 30% | any incorrect unit penalise **1** mark<br>allow **1** mark for the correct use of 600 **or** 0.3% **or** 30 | 2 |
| (c) | **1** mark for each correct link<br> | if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect | 3 |
| (d)(i) | 110 | no tolerance | 1 |
| (ii) | 12 | no tolerance | 1 |
| (iii) | wind speed may be too low to operate the generator | accept wind may not always blow<br>accept power depends on wind speed<br>accept does not generate if wind speed is too high<br>accept does not generate if wind speed is above 12 (m/s)<br>accept does not generate if wind speed is below 1.6 (m/s)<br>accept it is unreliable<br>do **not** accept answers referring to cost only | 1 |
| total | | | 10 |


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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | B E A D | allow **1** mark for each letter in the correct place, to a maximum of **3** marks | 3 |
| (b) | (a spark) may cause the (petrol vapour) to explode / ignite | accept petrol for (petrol vapour)<br>accept catch fire for explode | 1 |
| | connect tanker to earth with a (conducting) wire / chain **or** earth the tanker | accept ground for earth | 1 |
| (c) | **Quality of written communication** | for a logical sequence | 1 |
| | any **two** from: | | 2 |
| | • when current greater than fuse rating / value | accept when current too great for appliance<br>do **not** accept 'if there is too much current'<br>do **not** accept voltage or electricity | |
| | • fuse (becomes hot and) melts / burns out | accept fuse blows / breaks | |
| | • circuit is broken | accept circuit switched off<br>this cannot score credit on its own | |
| total | | | 8 |

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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | crust | | 1 |
| (ii) | inner core is <u>solid</u><br><br>outer core is liquid | do **not** accept just rock<br><br>inner core is denser / hotter than outer core gets **2** marks<br>accept one is solid and one is liquid for **1** mark<br>accept they are different densities for **1** mark<br>wrong way round = **0** marks | 1<br><br>1 |
| (b) | seismograph | | 1 |
| (c) | difficult to measure (slow) movement (1)<br>of plates (1) dependent mark<br>**or**<br>difficult to measure friction / forces (1)<br>between plates (1) dependent mark | | 1<br><br>1 |
| (d) | geothermal | | 1 |
| (e)(i) | 5000 | | 1 |
| (ii) | 2500 | | 1 |
| total | | | 9 |


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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q6**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 60 | | 1 |
| (b) | $5\frac{1}{2}$ hours | must include unit | 1 |
| (c) | 30 | | 1 |
| (d) | 30 minutes<br>or $\frac{1}{2}$ hour | must include unit | 1 |
| (e) | D **and** E<br><br>least steep part of the graph | accept finish for E<br>accept correct numbers from axes with units<br><br>accept covers smallest distance in a set time<br>accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6)<br><br>ignore horse is tired | 1<br><br>1 |
| total | | | 6 |

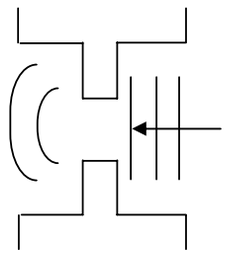
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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q7**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | any **one** from:<br>• (doctors) to see inside a patients body **or** endoscope<br>• telephone cables<br>• optical fibre / fibre optic lamps **or** (artificial) Christmas trees<br>• data transfer **or** internet connection | <br>accept keyhole surgery<br>do **not** accept flex **or** wires for cable<br>accept decorative / ornamental lighting<br>accept any feasible practical suggestion for taking light to a difficult to access place<br>do **not** accept lighting unqualified<br>do **not** accept lamp unqualified<br>do **not** accept communications unless clarified | 1 |
| (ii) | (incident) ray angle greater than critical angle<br>total internal reflection occurs | either order<br>accept (incident) ray greater than 42°<br>accept TIR<br>do **not** accept just description of TIR | 1<br>1 |
| (b)(i) | waves shown diffracting in the correct direction<br> | ignore wavelength | 1 |
| (ii) | diffraction | accept diffract / diffracted | 1 |
| total | | | 5 |

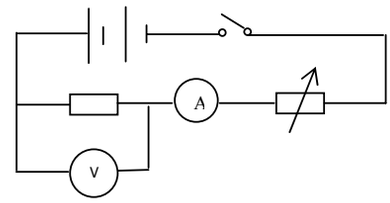
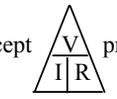

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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q8**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | all symbols correct | <br>accept push switch symbol<br>switch may be open or closed<br>any lines through symbols = **0** marks | 1 |
| | correct circuit drawn<br><br>voltmeter must be across resistor only | polarity of cells not relevant provided they are joined correctly<br>two cells are required in the diagram<br>ignore the order of the components<br>allow small gaps in circuit<br><br>omission of any component = **0** marks | 1 |
| (b)(i) | potential difference<br>= current × resistance | accept voltage or p.d. for potential difference<br><br>accept $V = I \times R$<br><br>accept  provided<br><br>subsequent use correct<br><br>do **not** accept C for current | 1 |
| (ii) | 2 | <br><br>allow **1** mark for correct substitution<br>wrong working loses both marks | 2 |
| (iii) | straight line drawn <u>through the origin</u><br><br>straight line passes through<br>$I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0 | judge by eye<br><br><br>this mark may be awarded if all points shown including these points are correct even if no line is drawn<br>N.B. a curve scores **0** marks | 1<br><br>1 dep |
| (c) | temperature <u>increases</u> | accept filament lamp / it gets <u>hotter</u><br>allow heat for temperature | 1 |
| total | | | 8 |

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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | gamma rays | accept gamma<br>accept correct symbol | 1 |
| (ii) | infra red | accept IR | 1 |
| (b) | ultraviolet <u>absorbed</u> by ink<br><br>(energy) given out as light | <br><br>accept glows / luminous<br>accept for **both** marks the ink is fluorescent<br>do **not** accept answers in terms of uv being reflected | 1<br><br>1 |
| (c) | any **two** from:<br><br>• UV can damage / kill / ionise / alter (normal) cells<br><br>• change DNA structure **or** mutate<br><br>• (normal) cells may become cancerous | <br><br>do **not** accept attacks cells **or** burns skin<br><br><br><br>accept may cause (skin) cancer<br>accept abnormal cell multiplication | 2 |
| (d)(i) | microwaves **and** infra red | both answers needed in either order<br><br>do **not** accept heat for IR | 1 |
| (ii) | 0.9 | <br><br>allow **1** mark for the <u>correct</u> use of<br>1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$<br>i.e. adding the correct 2 power values | 2 |
| total | | | 9 |


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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q10**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | accelerating | accept getting faster<br>accept speed / velocity increasing | 1 |
| (ii) | acceleration <u>increases</u> | accept velocity / speed increases <u>more</u> rapidly<br>do **not** accept velocity / speed increases | 1 |
| (b)(i) | $\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$ | accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$<br>do **not** accept velocity for change in velocity<br>do **not** accept change in speed<br>do **not** accept $a = \frac{v}{t}$ | 1 |
| (ii) | 15 | allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds | 2 |
| (iii) | velocity includes direction | accept velocity is a vector (quantity)<br>accept converse answer | 1 |
| (c) | force of gravity (between <u>shuttle</u> and Earth)<br><br>plus correct orbital speed (makes <u>shuttle</u> move in a curve) | accept gravitational pull if used correctly<br><br>accept forward motion **or** constant speed for orbital speed<br>accept it is travelling fast enough<br>accept for **2** marks the force of gravity provides the <u>centripetal</u> force | 1<br><br>1 |
| (d) | black is a good emitter of radiation<br>**or** to limit the temperature rise inside the shuttle | accept heat for radiation<br>accept the tiles are good insulation<br>do **not** accept black absorbs heat on its own<br>do **not** accept tiles are heat proof | 1 |
| total | | | 9 |

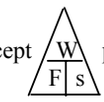
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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | work (done)<br>= force (applied) × distance (moved) | accept W = F × s or W = F × d<br><br>accept  provided<br><br>subsequent method is correct | 1 |
| (ii) | 240 000<br><br>joules | allow **1** mark for correct substitution **or** correct use of 1200 (N)<br><br>accept J<br>do **not** accept j / Nm | 2<br><br>1 |
| (b) | 800 (watts) | accept 0.8 kW<br>accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks<br><br>allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark | 2 |
| (c)(i) | any **one** from:<br>• needs to raise the chair / lift<br>• lifting more than one chair<br>• energy transfer to the surroundings correctly qualified | <br><br>allow lifting more than 2 people implication of a heavier weight<br><br>accept loss for transfer<br>do **not** accept motor inefficient<br>do **not** accept motor gets hot<br>do **not** accept friction unless the location is specified as external to the motor | 1 |
| (ii) | electrical<br><br>potential | accept electric<br><br>**both** answers required for the mark | 1 |
| total | | | 8 |


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## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | **Y** and **Z** | | 1 |
| | they have the same number of protons **or** same atomic number | accept they have the same number of electrons **or** same number of protons **and** electrons<br>allow only different in number of neutrons<br>N.B. independent marks | 1 |
| (b) | **Quality of written communication** | for correct use of terms underlined in B **or** C<br><br>Q ✓ Q X | 1 |
| | A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus<br><br>B – alpha particle deflected / repelled / repulsed by the (positive) nucleus<br><br>C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards | describes 3 tracks correctly for **2** marks<br>describes 2 or 1 track correctly for **1** mark<br><br>do **not** accept hits the nucleus<br>do **not** accept answers referring to refraction<br>do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion<br><br>mention of difference in charge on nucleus negates that track | max 2 |
| total | | | 5 |

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ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Physics 3451/F
*Specification B*

# Mark Scheme

*2005 examination – June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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# Physics (Specification B)
# Foundation Tier 3451/F

### 3451/F Q1

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | less than | accept any correct indication | 1 |
| (ii) | more than | accept any correct indication | 1 |
| (b) | any **two** from:<br><br>stays above the same place<br><br>above the equator<br><br>one orbit takes 24 hours | <br><br>do **not** accept stays in the same place<br><br>do **not** accept goes around equator unless qualified<br>do **not** accept orbit at same speed as Earth<br>do **not** accept orbit at a constant speed<br>accept has same angular speed / velocity as Earth | 2 |
| total | | | 4 |

### 3451/F Q2

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | comet | | 1 |
| (b) | large group / number / collection of stars | ignore reference to planets<br>accept millions of stars<br>do **not** accept thousands of stars<br>do **not** accept loads of stars | 1 |
| (c) | giant<br><br>supernova<br><br>neutron | | 1<br><br>1<br><br>1 |
| total | | | 5 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | radio | | 1 |
| (ii) | gamma | accept microwave<br>accept infrared | 1 |
| (iii) | ultra violet | | 1 |
| (iv) | microwaves | | 1 |
| (b) | the same as | | 1 |
| (c) | X-rays do not go through lead | references to gamma rays are incorrect<br>accept lead protects them from the X-rays<br>accept not exposed to X-rays | 1 |
| | lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u> | accept X-rays (may) cause cancer<br>accept organs for cell<br>do **not** accept references to electric shock<br>do **not** accept stops bones of people showing on X-ray<br>answers involving the horse wearing an apron are incorrect | 1 |
| | **Quality of written communication** | award for a sensible sequence of **two** points | 1 |
| total | | | 8 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2005 June series

**3451/F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | light<br><br>electrical | | 1<br><br>1 |
| (b) | 15% **or** 0.15 | correct substitution gains **1** mark only<br>an answer of 15 with no unit **or** an incorrect unit gains **1** mark<br>an answer of 0.15 given with a unit gains **1** mark | 2 |
| (c) | the ticket machine is a long way from other electricity supplies | | 1 |
| (d) | any figure between 5 and 10 inclusive | unit not required but if given must match numerical answer | 1 |
| total | | | 6 |

**3451/F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | radon (gas) | do **not** accept gas | 1 |
| (ii) | background | | 1 |
| (b) | bigger | accept any word which means bigger | 1 |
| (c) | **Z**<br><br>alpha will not pass through aluminium or lead | if Z is not given, the reason does not score<br>accept alpha cannot go through metals / dense material<br>accept there is nothing to stop the radiation<br>accept alpha will not pass through aluminium<br>do **not** accept alpha will not pass through lead<br>do **not** accept alpha stopped by air | 1<br><br>1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q6**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | loses negative charge / electrons | do **not** accept positive charge transfers to the comb<br>do **not** accept friction | 1 |
| (b) | **A** attract | | 1 |
| | **B** repel | | 1 |
| | **C** attract | | 1 |
| (c) | **F A D E** | allow **2** marks for 2 letters in the correct place<br>allow **1** mark for 1 letter in the correct place | 3 |
| total | | | 7 |

## 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2005 June series

**3451/F Q7**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | all points correctly plotted | tolerance ± $\frac{1}{2}$ square on y axis only<br>allow **1** mark for 3 correctly plotted points | 2 |
| | attempt made to draw a smooth curve | do **not** accept dot-to-dot line | 1 |
| (b)(i) | 3 days ± 0.2<br>**or**<br>any value correctly obtained using their graph line | if no line drawn in (a), answer must be exactly 3 | 1 |
| (ii) | 3 days or their (b)(i) | | 1 |
| (c) | radon-222 | accept radon **or** 222<br>accept alpha or 3.8<br>correct isotope required for reason to score | 1 |
| | has the shortest half-life | accept the others have longer half-lives | 1 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q8**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | fossils of Cynognathus are found in Africa and South America | | 1 |
| | the shapes ……. almost fit together | only two boxes should be ticked<br>deduct **1** mark for each additional box<br>to a minimum mark of **0** | 1 |
| (b) | continental | | 1 |
| | crust | | 1 |
| | tectonic | | 1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | capacitor<br><br>LDR<br><br>relay (normally open) | accept condenser<br><br>**or** light dependent resistor<br>accept 'ldr', 'Ldr' etc.<br><br>do **not** accept 'relay normally closed' | 1<br><br>1<br><br>1 |
| (b)(i) | battery | accept '(battery of) cells'<br>do **not** accept 'battery / cell' | 1 |
| (ii) | LED | **or** light emitting diode<br>accept 'led' or 'Led'<br>do **not** accept just 'diode' | 1 |
| (iii) | B will light (but C will not) | accept '(only) B will work'<br>accept 'one is on the other is off'<br>do **not** accept 'C is on and B is off' | 1 |
| (iv) | any **one** from:<br><br>B is connected the right way round (and C is not)<br><br>a (light emitting) diode only allows (a significant) current to flow in one direction<br><br>B's anode is connected to the positive side of the supply<br><br>B's cathode is connected to the negative terminal | N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction<br><br>if (iv) is completely consistent with (iii) which is wrong, allow **1** mark | 1 |
| (c)(i) | first input / second input / output<br>0 / 0 / **0**<br>1 / 0 / **0**<br>0 / 1 / **0**<br>1 / 1 / **1** | **all** correct<br><br>allow:<br>OFF NO<br>OFF NO<br>OFF NO<br>ON YES | 1 |
| (ii) | truth (table) | | 1 |

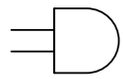
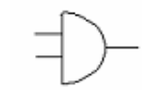
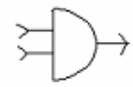
**cont…**

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q9 cont…**

| | | | |
|---|---|---|---|
| (iii) |  | a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction<br><br>allow   | 1 |
| (d) | light sensor | **or** light dependent resistor<br>**or** LDR<br>accept 'ldr', Ldr' etc<br>allow solar cell, photo cell | 1 |
| | NOT gate | accept 'Not gate' **or** 'not gate'<br><br>if both correct but in the wrong order credit with **1** mark | 1 |
| total | | | 12 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q10**

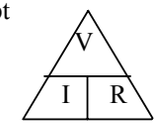
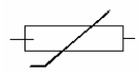
| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | rays continued to meet on the right hand side of the lens and beyond | must be straight lines from the right hand side of the lens<br>ignore details through the lens<br>allow if no arrows | 1 |
| | meet exactly on the axis | negate mark if contradictory arrow(s) added<br>do not need to go beyond the focus for this mark | 1 |
| (ii) | (principal) focus | **or** focal (point) | 1 |
| (iii) | converging | **or** convex | 1 |
| (b)(i) | **A** | | 1 |
| (ii) | rays seem to come from this point | **or** words to this effect<br>**or** shows this on the diagram | 1 |
| (iii) | diverging | **or** concave | 1 |
| (c) | film | accept any unambiguous method of showing the correct response | 1 |
| | smaller than | | 1 |
| | further away from | | 1 |
| (d) | any **three** from:<br>• real image can be put on a screen<br>• virtual image cannot be put on a screen / film<br>• virtual image is imaginary<br>• real image is formed where (real) rays cross / converge<br>• virtual image is where virtual / imaginary rays (seem to) come from<br>• virtual image formed where virtual rays intersect / cross | allow film<br><br>allow real image has light travelling through it<br>**or** virtual image is where rays seem to come from | 3 |
| total | | | 13 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | $A_1 = 0.5$ | ignore any units | 1 |
| | $A_4 = 0.5$ | allow **1** mark for $A_1 = A_4 \neq 0.5$ | 1 |
| (ii) | the resistance of **P** is more than 20 Ω | | 1 |
| | a smaller current goes through P / $A_2$ (than 20 Ω) | dependent on getting 1st mark correct<br>accept converse | 1 |
| (b)(i) | potential difference = current × resistance | accept pd / voltage for potential difference<br>accept V = I × R, correct symbols and correct case only<br>accept volts = amps × ohms<br>accept <br>provided subsequent method is correct<br>allow combination of physical quantities and named units<br>allow voltage = I × R | 1 |
| (ii) | 6 | allow **1** mark for correct substitution | 2 |
| (iii) | 6 | accept their (b)(ii) | 1 |
| (c) | thermistor or  | accept correct circuit symbol<br>allow phonetic spelling | 1 |
| | resistance goes down (as temperature of thermistor goes up) | do **not** accept changes for goes down<br>do **not** accept an answer in terms of current only<br>answers in terms of other components are incorrect | 1 |
| total | | | 10 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2005 June series

**3451/F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | larger the distance, greater the time | accept 'they are proportional'<br>accept converse | 1 |
| (ii) | any value between 6 and 9 years inclusive | | 1 |
| (b)(i) | carbon dioxide | | 1 |
| (ii) | (Venus) has high**er** temperature (than Mercury) | accept has the high**est** temperature<br>accept Venus is hotter / hottest<br><br>do **not** accept has a high / very high temperature | 1 |
| | (Venus) further from the Sun than Mercury | accept 'Venus is not the closest planet to the Sun'<br><br>answer in terms of greenhouse effect only, scores **0** marks | 1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q13**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | 20 | | 1 |
| (ii) | convection | | 1 |
| (iii) | fit draughtproof strips | accept lay carpet<br>accept fit curtains<br>accept close doors / windows / curtains<br>accept any reasonable suggestion for reducing a draught<br>'double glazing' alone is insufficient | 1 |
| (b) | air is (a good) insulator<br>**or**<br>air is a poor conductor | accept air cavity / 'it' for air | 1 |
| | reducing heat transfer by <u>conduction</u> | accept stops for reduces<br>ignore convection<br>do **not** accept radiation<br>do **not** accept answers in terms of heat being trapped | 1 |
| (c)(i) | most cost effective | accept it is cheaper or low<u>est</u> cost<br>accept shortest payback time<br>accept in terms of reducing heat loss by the largest amount<br>do **not** accept it is easier<br>ignore most heat is lost through the roof | 1 |
| (ii) | 4 | | 1 |
| total | | | 7 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q14**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | constant speed | do **not** accept normal speed<br>do **not** accept it is stopped / stationary | 1 |
| | in a straight line | accept any appropriate reference to a direction<br><br>constant velocity gains **2** marks<br>'not accelerating' gains **2** marks<br><br>terminal velocity alone gets **1** mark | 1 |
| (ii) | goes down owtte | accept motorbike (it) slows down | 1 |
| (b)(i) | 20 (m/s) | ignore incorrect units | 1 |
| (ii) | acceleration = change in velocity / time (taken) | do **not** accept velocity for change in velocity<br>accept change in speed<br>accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$<br>do **not** accept $a = \frac{v}{t}$ | 1 |
| (iii) | 4<br>**or** their (b)(i) ÷ 5 | allow **1** mark for correct substitution | 2 |
| | $m/s^2$ | m/s/s **or** $ms^{-2}$ **or** metres per second squared **or** metres per second per second | 1 |
| (c) | vehicle may skid / slide | loss of control / brakes lock / wheels lock<br>accept greater stopping distance **or** difficult to stop | 1 |
| | due to reduced friction (between tyre(s) and road) | accept due to less grip<br>do **not** accept no friction | 1 |

**cont…**

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q14 cont**…

| | | | |
|---|---|---|---|
| (d) | any **three** from:<br>• <u>increased</u> speed<br>• <u>reduced</u> braking force<br>• <u>slower</u> (driver) reactions<br>• <u>poor</u> vehicle maintenance<br>• <u>increased</u> mass / weight of vehicle<br>• <u>poor</u> road surface<br>• <u>more</u> streamlined | do **not** accept night time / poor vision<br>N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc<br>specific examples may **each** gain credit eg worn brakes or worn tyres etc<br>accept large mass / weight of vehicle<br>if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only | 3 |
| total | | | 13 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2005 June series

**3451/F Q15**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | arrow from centre of the ball<br>**and** at right angles to the string<br>**and** in the correct direction | arrow should point to the student's belt<br>accept free-hand 'straight' line<br>do **not** accept curved line | 1 |
| (ii) | increase<br>increase<br>increase | accept 'be stronger / bigger'<br>accept 'be stronger / bigger'<br>accept 'be stronger / bigger' | 1<br>1<br>1 |
| (b) | speed<br>velocity<br>direction | all **three** correct<br><br>any two correct for **1** mark<br>otherwise **0** marks | 2 |
| (c)(i) | centripetal | accept 'centripedal' and other minor misspellings<br>do **not** accept anything which could be 'centrifugal' | 1 |
| (ii) | gravity | accept 'weight'<br>accept 'force of attraction due to mass(es) (of the Moon and the Earth)' | 1 |
| (iii) | electron(s) | | 1 |
| (iv) | electrostatic | accept 'electrical'<br>do **not** accept just 'centripetal' | 1 |
| total | | | 10 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q16**

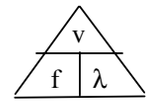
| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | **X** at the centre of the lifebelt | measuring from the centre of **X**, allow 2 mm tolerance in any direction | 1 |
| (ii) | any **two** from:<br><br>below the point of suspension<br><br>at the centre (of the lifebelt)<br><br>(because) the lifebelt / it is symmetrical | if X is on vertical line below the hanger (but not at centre) can gain the first point only<br><br>accept '(vertically) below **Y**'<br><br>accept 'in the middle'<br><br>**or** (because) the mass / weight is evenly distributed | 2 |
| (b) | Nm **or** newton metre(s)<br><br>750 | accept Newton metre(s)<br>do **not** accept any ambiguity in the symbol ie NM, nM or nm<br><br>(moment) = force × (perpendicular) distance (between line of action and pivot)<br>**or** (moment) = 500 × 1.5 gains<br>**1** mark | 1<br><br>2 |
| (c) | **Quality of written communication**:<br><br>any **three** connected points from:<br><br>low(er) <u>centre of mass / gravity</u><br><br>(more) <u>stable</u><br><br>less likely to fall over<br><br>the <u>turning effect / moment</u> (of the weight of case) is less<br><br>so the pull on her arm is less | for **2** of the underlined terms used in the correct context<br><br><br>**or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground<br><br>**or** less <u>unstable</u><br><br>accept 'less likely to overturn'<br>do **not** accept 'will not fall over'<br><br><br>**or** so less effort is needed to hold the case<br>ignore references to pulling the case | 1<br><br>3 |
| total | | | 10 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2005 June series

**3451/F Q17**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | any **two** from:<br>• **amplitude** decreasing<br>• **wavelength** increasing<br>• **frequency** decreasing<br><br>**Quality of written communication** | accept siren / sound getting quieter<br>do **not** accept sound decreases<br><br>accept pitch decreasing<br>ignore reference to transverse wave<br>ignore reference to speed<br><br>contradictory statements within each point lose the mark<br><br>all emboldened terms in candidate's answer used correctly | 2<br><br>1 |
| (b)(i) | ultrasound **or** ultrasonic | | 1 |
| (ii) | wave speed = frequency × wavelength | accept speed / velocity for wave speed<br><br>accept $v = f \times \lambda$<br>do **not** accept w for $\lambda$<br>do **not** accept s for v<br><br>accept <br><br><br>provided subsequent calculation shows a correct method | 1 |
| (iii) | 339.2 **or** 340 **or** 339 | allow **1** mark for using 212 000<br>allow **1** mark for correct substitution<br><br>an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only<br>award full credit for a correct numerical answer with the unit changed to km/s | 3 |
| total | | | 8 |

Version 1.0: *27092005*

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Science: Double Award 3462/3F
*Specification B (Co-ordinated)*

# Mark Scheme

## *2005 examination - June series*

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**4.4.1.2 Mass number, atomic number and isotopes**



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

# Double Award
# Foundation Tier 3462/3F

**3462/3F Q1**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | less than | accept any correct indication | 1 |
| (ii) | more than | accept any correct indication | 1 |
| (b) | any **two** from:<br><br>stays above the same place<br><br>above the equator<br><br>one orbit takes 24 hours | <br><br>do **not** accept stays in the same place<br><br>do **not** accept goes around equator unless qualified<br>do **not** accept orbit at same speed as Earth<br>do **not** accept orbit at a constant speed<br>accept has same angular speed / velocity as Earth | 2 |
| total | | | 4 |

**3462/ 3F Q2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | comet | | 1 |
| (b) | large group / number / collection of stars | ignore reference to planets<br>accept millions of stars<br>do **not** accept thousands of stars<br>do **not** accept loads of stars | 1 |
| (c) | giant<br><br>supernova<br><br>neutron | | 1<br><br>1<br><br>1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | radio | | 1 |
| (ii) | gamma | accept microwave<br>accept infrared | 1 |
| (iii) | ultra violet | | 1 |
| (iv) | microwaves | | 1 |
| (b) | the same as | | 1 |
| (c) | **Quality of written communication** | award for a sensible sequence of **two** points | 1 |
| | X-rays do not go through lead | accept lead protects them from the X-rays<br>accept not exposed to X-rays | 1 |
| | lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u> | accept X-rays (may) cause cancer<br><br>accept organs for cell<br>do **not** accept references to electric shock<br>do **not** accept stops bones of people showing on X-ray<br>answers involving the horse wearing an apron are incorrect<br><br>references to gamma rays are incorrect | 1 |
| total | | | 8 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | light<br><br>electrical | | 1<br><br>1 |
| (b) | 15% **or** 0.15 | correct substitution gains **1** mark only<br>an answer of 15 with no unit **or** an incorrect unit gains **1** mark<br>an answer of 0.15 given with a unit gains **1** mark | 2 |
| (c) | the ticket machine is a long way from other electricity supplies | | 1 |
| (d) | any figure between 5 and 10 inclusive | unit not required but if given must match numerical answer | 1 |
| total | | | 6 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | radon (gas) | do **not** accept gas | 1 |
| (ii) | background | | 1 |
| (b) | bigger | accept any word which means bigger | 1 |
| (c) | **Z**<br><br>alpha will not pass through aluminium or lead | if Z is not given, the reason does not score<br>accept alpha cannot go through metals / dense material<br>accept there is nothing to stop the radiation<br>accept alpha will not pass through aluminium<br>do **not** accept alpha will not pass through lead<br>do **not** accept alpha stopped by air | 1<br><br>1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q6**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | loses negative charge / electrons | do **not** accept positive charge<br>transfers to the comb<br>do **not** accept friction | 1 |
| (b) | **A** attract | | 1 |
| | **B** repel | | 1 |
| | **C** attract | | 1 |
| (c) | **F A D E** | allow **2** marks for 2 letters in the correct place<br>allow **1** mark for 1 letter in the correct place | 3 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q7**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | all points correctly plotted | tolerance ± $\frac{1}{2}$ square on y axis only<br>allow **1** mark for 3 correctly plotted points | 2 |
| | attempt made to draw a smooth curve | do **not** accept dot-to-dot line | 1 |
| (b)(i) | 3 days ± 0.2<br>**or**<br>any value correctly obtained using their graph line | if no line drawn in (a), answer must be exactly 3 | 1 |
| (ii) | 3 days or their (b)(i) | | 1 |
| (c) | radon-222 | accept radon **or** 222<br>accept alpha or 3.8<br>correct isotope required for reason to score | 1 |
| | has the shortest <u>half-life</u> | accept the others have longer <u>half-lives</u> | 1 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q8**

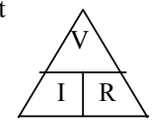
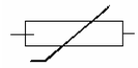
| question | answers | extra information | mark |
|---|---|---|---|
| (a) | fossils of Cynognathus are found in Africa and South America | | 1 |
| | the shapes ……. almost fit together | only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0** | 1 |
| (b) | continental | | 1 |
| | crust | | 1 |
| | tectonic | | 1 |
| total | | | 5 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | $A_1 = 0.5$<br><br>$A_4 = 0.5$ | ignore any units<br><br>allow **1** mark for $A_1 = A_4 \neq 0.5$ | 1<br><br>1 |
| (ii) | the resistance of **P** is more than 20 Ω<br><br>a smaller current goes through P / $A_2$ (than 20 Ω) | <br><br>dependent on getting 1st mark correct<br>accept converse | 1<br><br>1 |
| (b)(i) | potential difference = current × resistance | accept pd / voltage for potential difference<br>accept V = I × R, correct symbols and correct case only<br>accept volts = amps × ohms<br>accept <br>provided subsequent method is correct<br>allow combination of physical quantities and named units<br>allow voltage = I × R | 1 |
| (ii) | 6 | allow **1** mark for correct substitution | 2 |
| (iii) | 6 | accept their (b)(ii) | 1 |
| (c) | <u>thermistor</u> or <br><br><u>resistance</u> goes down (as temperature of thermistor goes up) | accept correct circuit symbol<br>allow phonetic spelling<br><br>do **not** accept changes for goes down<br>do **not** accept an answer in terms of current only<br>answers in terms of other components are incorrect | 1<br><br>1 |
| total | | | 10 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q10**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | larger the distance, greater the time | accept 'they are proportional'<br>accept converse | 1 |
| (ii) | any value between 6 and 9 years inclusive | | 1 |
| (b)(i) | carbon dioxide | | 1 |
| (ii) | (Venus) has high**er** temperature (than Mercury) | accept has the high**est** temperature<br>accept Venus is hotter / hottest<br><br>do **not** accept has a high / very high temperature | 1 |
| | (Venus) further from the Sun than Mercury | accept 'Venus is not the closest planet to the Sun'<br><br>answer in terms of greenhouse effect only, scores **0** marks | 1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | 20 | | 1 |
| (ii) | convection | | 1 |
| (iii) | fit draughtproof strips | accept lay carpet<br>accept fit curtains<br>accept close doors / windows / curtains<br>accept any reasonable suggestion for reducing a draught<br>'double glazing' alone is insufficient | 1 |
| (b) | air is (a good) insulator<br>**or**<br>air is a poor conductor | accept air cavity / 'it' for air | 1 |
| | reducing heat transfer by <u>conduction</u> | accept stops for reduces<br>ignore convection<br>do **not** accept radiation<br>do **not** accept answers in terms of heat being trapped | 1 |
| (c)(i) | most cost effective | accept it is cheaper or low<u>est</u> cost<br>accept shortest payback time<br>accept in terms of reducing heat loss by the largest amount<br>do **not** accept it is easier<br>ignore most heat is lost through the roof | 1 |
| (ii) | 4 | | 1 |
| total | | | 7 |

## 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | constant speed | do **not** accept normal speed<br>do **not** accept it is stopped / stationary | 1 |
| | in a straight line | accept any appropriate reference to a direction<br><br>constant velocity gains **2** marks<br>'not accelerating' gains **2** marks<br><br>terminal velocity alone gets **1** mark | 1 |
| (ii) | goes down owtte | accept motorbike (it) slows down | 1 |
| (b)(i) | 20 (m/s) | ignore incorrect units | 1 |
| (ii) | acceleration = change in velocity / time (taken) | do **not** accept velocity for change in velocity<br>accept change in speed<br>accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$<br>do **not** accept $a = \frac{v}{t}$ | 1 |
| (iii) | 4<br>**or** their (b)(i) ÷ 5 | allow **1** mark for correct substitution | 2 |
| | $m/s^2$ | m/s/s **or** $ms^{-2}$ **or** metres per second squared **or** metres per second per second | 1 |
| (c) | vehicle may skid / slide | loss of control / brakes lock / wheels lock<br>accept greater stopping distance **or** difficult to stop | 1 |
| | due to reduced friction (between tyre(s) and road) | accept due to less grip<br>do **not** accept no friction | 1 |

**cont…**

**3462/3F Q12 cont**…

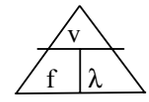
| | | | |
|---|---|---|---|
| (d) | any **three** from:<br>• <u>increased</u> speed<br>• <u>reduced</u> braking force<br>• <u>slower</u> (driver) reactions<br>• <u>poor</u> vehicle maintenance<br>• <u>increased</u> mass / weight of vehicle<br>• <u>poor</u> road surface<br>• <u>more</u> streamlined | do **not** accept night time / poor vision<br><br>NB specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc<br><br>specific examples may **each** gain credit eg worn brakes or worn tyres etc<br><br>accept large mass / weight of vehicle<br><br>if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only | 3 |
| total | | | 13 |

## 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2005 June series

**3462/3F Q13**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | **Quality of written communication** | all emboldened terms in candidate's answer used correctly | 1 |
| | any **two** from:<br>• **amplitude** decreasing<br>• **wavelength** increasing<br>• **frequency** decreasing | accept siren / sound getting quieter<br>do **not** accept sound decreases<br>accept pitch decreasing<br>ignore reference to transverse wave<br>ignore reference to speed<br>contradictory statements within each point lose the mark | 2 |
| (b)(i) | ultrasound **or** ultrasonic | | 1 |
| (ii) | wave speed = frequency × wavelength | accept speed / velocity for wave speed<br>accept $v = f \times \lambda$<br>do **not** accept w for λ<br>do **not** accept s for v<br>accept <br>provided subsequent calculation shows a correct method | 1 |
| (iii) | 339.2 **or** 340 **or** 339 | allow **1** mark for using 212 000<br>allow **1** mark for correct substitution<br>an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only<br>award full credit for a correct numerical answer with the unit changed to km/s | 3 |
| total | | | 8 |

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Physics 3451/F
*Specification B*

# Mark Scheme

## *2006 examination - June series*

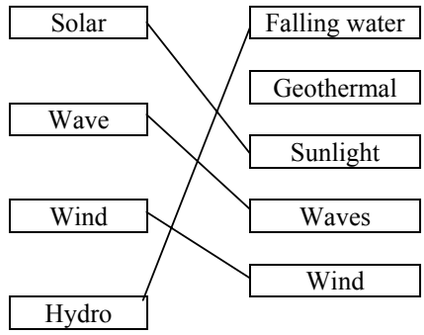
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# Physics (Specification B)
# Foundation Tier 3451/F

**3451/F Q1**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 4 correct lines drawn<br><br> | **1** mark for each correct line<br><br>if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines | 4 |
| (b) | 4 | | 1 |
| (c)(i) | nuclear | | 1 |
| (ii) | (natural) gas | do **not** accept natural | 1 |
| total | | | 7 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | ultra violet | | 1 |
| (ii) | kill the cells | accept destroys the cells<br>accept makes cells cancerous<br>accept damage cells<br>accept harms cells<br>accept changes DNA<br>accept cause cells to mutate<br>accept skin cells for cells<br>accept cause cancer<br>do **not** accept skin for cells<br>do **not** accept burns the cells | 1 |
| (b)(i) | the sunbed uses an alternating current (a.c.) supply | | 1 |
| (ii) | 10.8 | accept **1** mark for correct substitution of power in W or kW and time in hours or seconds | 2 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | M | | 1 |
| (ii) | K | | 1 |
| (iii) | J | | 1 |
| (iv) | O | | 1 |
| (b)(i) | billions of years | | 1 |
| (ii) | red giant | any answer in terms of explosion or supernova is **incorrect** | 1 |
| | contracts / shrinks to | incorrect reference to black hole negates **1** mark | 1 |
| | white dwarf | | 1 |
| total | | | 8 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | A and C | **both** answers must be correct<br><br>in either order | 1 |
| (ii) | A and B | **both** answers must be correct<br><br>in either order | 1 |
| (iii) | same number of protons plus neutrons<br>**or**<br>same number of nucleons | accept number of particles in nucleus the same<br><br>do **not** accept they add up to 6 unless qualified | 1 |
| (b)(i) | any **two** from:<br>• boron - 12<br>• carbon - 14<br>• oxygen - 15<br>• lead - 209 | **both** required<br><br>both name **and** number must be given | 1 |
| (ii) | any **two** from:<br>• boron - 11<br>• carbon - 12<br>• oxygen - 16<br>• lead - 207 | **both** required<br><br>both name **and** number must be given | 1 |
| (c) | alpha | | 1 |
| total | | | 6 |

## 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2006 June series

**3451/F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | (good) insulator | accept does not conduct (electricity)<br>accept does not conduct heat or electricity<br>do **not** accept does not conduct heat<br>outside is tough is insufficient | 1 |
| (b) | fuse | | 1 |
| (c) | connect the green and yellow / earth wire | accept wires must be connected to screws | 1 |
| | swap the brown and blue wires round | | 1 |
| total | | | 4 |

**3451/F Q6**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | fossils | answers can be in either order | 1 |
| | water | | 1 |
| (b) | increased | | 1 |
| (c) | radio telescope | | 1 |
| total | | | 4 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q7**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | electrical<br><br>kinetic | <br><br>accept movement | 1<br><br>1 |
| (ii) | heat<br><br>sound | answers can be in either order<br><br> | 1<br><br>1 |
| (b)(i) | 360 | accept **1** mark for correct substitution | 2 |
| (ii) | watt | | 1 |
| (c) | the stairlift is not moving<br>the stairlift is moving at constant speed | **both** answers are required for the mark | 1 |
| total | | | 8 |

**3451/F Q8**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | (up) further<br>**or**<br>(up) faster | any reference to downwards movement loses credit<br>accept <u>with</u> more force<br>accept motion would increase | 1 |
| (ii) | down | accept the opposite way<br><br>accept drop | 1 |
| (b)(i) | direct current | | 1 |
| (ii) | Z | | 1 |
| total | | | 4 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | level of radiation (detected) will not change | ignore reference to particles | 1 |
| | if thickness of aluminium changes | accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same.<br><br>accept for **1** mark gamma will pass through aluminium | 1 |
| | QoWC for 2 points in a sensible sequence | | 1 |
| (b) | S W T V | all in correct order<br><br>accept **2** marks for 2 correct<br><br>accept **1** mark for 1 correct | 3 |
| total | | | 6 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q10**

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>thermistor(s)<br>LDR(s)<br>switch(es)<br>LED(s)<br>buzzer(s)<br>motor(s)</td><td>1 mark each<br>or light dependent resistor(s)<br>or light emitting diode(s)</td><td>6</td></tr>
<tr><td>(b)(i)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td>both correct</td><td>1</td></tr>
<tr><td>(iii)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(c)(i)</td><td></td><td>do not credit any attempt which could equally well be a poorly drawn attempt at the symbol for a cell</td><td>1</td></tr>
<tr><td>(ii)</td><td>charge<br><br>increases</td><td>accept ‘electrons’<br>accept ‘energy<br>or gets bigger/larger</td><td>1<br><br>1</td></tr>
<tr><td>total</td><td></td><td></td><td>12</td></tr>
</table>

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | A | | 1 |
| (ii) | B | | 1 |
| (iii) | mass is larger | credit if the response is clear by some other means<br>e.g. it is ringed | 1 |
| | wire is shorter | credit if the response is clear by some other means<br>e.g. it is ringed | 1 |
| (b) | moment | | 1 |
| | distance | | 1 |
| (c)(i) | 1 | | 1 |
| (ii) | 5 | | 1 |
| (iii) | any **two** from<br>• remove slotted mass(es)<br>• slide (slotted) masses / weights nearer pivot<br>• slide forcemeter away from the pivot<br>• slide rod to the left | <br><br>**or** ….. to the left<br><br>**or** ….. to the right<br><br>**or** …. so that the slotted masses side is shorter<br>**or** …. so that the forcemeter side is longer | 2 |
| (d) | centre of the rectangle | accept *2*mm tolerance any direction | 1 |
| | centre of the circle | accept *2*mm tolerance any direction | 1 |
| | on centre line<br>and 10mm above base | accept *2*mm tolerance any direction | 1 |
| total | | | 13 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 0.05 (A) | ignore incorrect units if given<br>accept 'the same' / 'the same as K' / 'the same as the other ammeter'<br>do **not** accept 'same as the other meter' | 1 |
| (b)(i) | any **two** from:<br>• two cells are joined + to + | answers in terms of current gain no marks<br>accept one cell in the wrong way<br>accept two cells are joined back-to-back<br>accept two cells are joined – to –<br>accept battery for cell<br>do **not** accept answers in terms of all the cells or in terms of energy only | 2 |
| | • some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components | accept voltage for pd<br>do **not** accept using up pd | |
| | • the other components have a resistance | accept a named component / components / wire has a resistance | |
| | • cells not fully charged **or** cells partially run down | do **not** accept voltage of cells is less than 1.5 unless explained<br>do **not** accept cells are not as powerful unless explained | |
| | • cells have an internal resistance | | |
| (ii) | the diode has a (very) high resistance (in the reverse direction) | | 1 |
| | a diode only conducts / allows current to flow in one direction | accept little / no current flows<br>do **not** accept blocks / cuts flow | 1 |

**Continued**

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2006 June series

**3451/F Q12**

| question | answers | extra information | mark |
|---|---|---|---|
| (c) | **QoWC** for the use of the word resistance | annotate Q✓ Q✗<br>accept resistant | 1 |
| | accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral | | |
| | as the pd / current increases / changes | accept voltage for pd<br>must be correctly linked to at least one of the following points accept | 1 |
| | the temperature of the filament increases / changes | lamp / bulb for filament<br>accept filament becomes hotter | 1 |
| | increasing / changing the **resistance** of the lamp | | 1 |
| | | accept for **1** mark only the filament lamp does not obey Ohm's law | |
| total | | | 9 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q13**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 0.5 | | 1 |
| | hertz | accept Hz but **not** HZ / hz / hZ<br><br>accept (waves) per second **or** / sec **or** / s **or** $s^{-1}$ **or** $sec^{-1}$ | 1 |
| (b) | any **one** from:<br><br>• any named part of the electromagnetic spectrum<br>• S – waves / secondary waves<br>• wave on a rope | <br><br><br>do **not** accept seismic waves / earthquake<br><br>do **not** accept slinky unless clearly described | 1 |
| (c) | transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel | accept a correctly labelled diagram | 1 |
| | longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel | accept a correctly labelled diagram<br><br>part explanation of the difference between transverse **and** longitudinal gains **1** mark | 1 |
| (d)(i) | TIR shown | needs to stay inside water jet<br><br>ignore number of reflections **or** arrow heads<br><br>lines straight by eye | 1 |
| (ii) | bigger than | any indication of correct answer | 1 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2006 June series

**3451/F Q14**

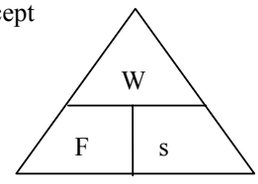
| question | answers | extra information | mark |
|---|---|---|---|
| (a) | W | | 1 |
| | has only two states<br>**or**<br>is either on or off | accept discrete values only<br><br>do **not** credit answer purely in terms of shape | 1 |
| (b) | any **one** from: | | 1 |
| | • higher quality | accept clearer<br><br>do **not** accept easier to read<br><br>ignore faster<br><br>accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength<br><br>do **not** accept no distortion / weakening on its own | |
| | • increased carrying capacity | accept more information can be sent **or** more channels | |
| | • errors can be rectified | | |
| total | | | 3 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q15**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | all points plotted accurately | accept **1** mark for 5 correct plots<br>± ½ small square on stopping distance | 2 |
| | line of best fit must be continuous | accept attempt at a reasonable curve<br>does not need to go through 0 0<br>do **not** accept a straight line<br>do **not** accept dot-to-dot | 1 |
| (ii) | 4 to 6 (metres) | accept ecf from (a)(i)<br>accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown | 2 |
| (b)(i) | 0.7 (s) | incorrect unit = 0 marks | 1 |
| (ii) | constant speed / velocity | accept (continued as) 30mph<br>accept did not change / stayed the same<br>accept no acceleration | 1 |
| (iii) | 3.3(s) | penalise incorrect unit once only | 1 |
| (iv) | reaction time <u>increases</u> / is <u>longer</u> **or** thinking distance <u>increases</u> | do **not** accept reaction time slower **or** reactions are slower | 1 |
| | stopping distance / it <u>increases</u> | do **not** accept travels at constant speed for longer | 1 |
| (c)(i) | work done =<br>force (applied) × distance (moved) | accept W = F × s or W = F × d<br>accept <br><br>provided subsequent method is correct | 1 |

**Continued**

### 4.4.1.2 Mass number, atomic number and isotopes



*Physics B* – AQA GCSE Mark Scheme, 2006 June series

**3451/F Q15**

| question | answers | extra information | mark |
|---|---|---|---|
| (ii) **E** | 2100 | accept 2.1 kilo<br>accept **1** mark for using 7000 N | 2 |
| (iii) | 2100 (joules) | accept their (c)(ii) | 1 |
| total | | | 14 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q16**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | refraction | | 1 |
| (ii) | it changes speed<br>**or**<br>change in density | accept it speeds up<br><br>do **not** accept it slows down<br><br>do **not** accept air is more dense than glass | 1 |
| (b)(i) | sound / waves <u>diffract</u><br><br>through the gap (in the wall)<br>**or**<br>over the wall<br>**or**<br>because the gate is open | do **not** accept reflection<br><br>this only scores if first marking point is given<br><br>accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates<br><br>if diagram is labelled as diffraction both marks can be scored | 1<br><br>1 |
| (ii) | less diffraction | accept no diffraction<br><br>accept gates <u>absorb</u> sound / noise / waves<br><br>accept gates <u>reflect</u> sound / noise / waves<br><br>do **not** accept rebounds / stops / blocks out | 1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q17**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | both rays brought to a focus at F on the right | do **not** have to be continued beyond F | 1 |
| | lines have been drawn **accurately** with a ruler | only credit if 1st mark credited<br>do **not** credit if contradictory arrow(s) added | 1 |
| (b) | rays seem to come from a focus at G on the left and continued to the right of the lens | this mark is for the current idea of divergence | 1 |
| | lines have been drawn **accurately** with a ruler | only credit if 1st mark credited<br>do **not** credit if contradictory arrow(s) added | 1 |
| (c) | …lens…<br>…image…<br>…object…<br>…image…<br>...object…<br>…lens… | lens as 1st and 6th words (1)<br>image and object in the correct order 2nd and 3rd words (1)<br>image and object in correct order 4th and 5th words (1) | max 3 |
| (d)(i) | correct statement about real image<br>real rays intersect / cross to form a real image<br>**or** a real image can be formed on a screen<br>**or** real image is (always) on the opposite side (of the lens)<br>**or** real image is (always) upside down (to the object) | may be credited from a correct diagram | 1 |
| | correct statement about virtual / imaginary image<br>virtual / imaginary rays intersect / cross to form a virtual image<br>**or** a virtual / imaginary image cannot<br>**or** virtual / imaginary image is (always) on the same side (of the lens)<br>**or** virtual / imaginary image is (always) same way up (as the object) | may be credited from a correct diagram | 1 |

**Continued**

### 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q17**

| question | answers | extra information | mark |
|---|---|---|---|
| (ii) | **either**<br>image needs to fall on / affect the film<br>**or** image needs to fall on / affect the light sensors / charged coupled devices (CCDs) (in a digital camera / mobile phone)<br>**or** image needs to cause a chemical reaction (in / on the film) | | 1 |
| total | | | 10 |

## 4.4.1.2 Mass number, atomic number and isotopes





**3451/F Q18**

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>AND (gate)<br><br>OR (gate)<br><br>NOT (gate)<br><br>LED or light emitting diode</td><td>accept ‘and’<br><br>accept ‘or’<br><br>accept ‘not’ or invert gate<br><br>accept ‘led’</td><td>1<br><br>1<br><br>1<br><br>1</td></tr>
<tr><td>(b)(i)</td><td>NOT (gate) and AND (gate)</td><td>both in either order or ‘(the) gates’<br><br>any additions lose the mark</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Switch for fire</th><th>Tilt switch</th><th>Signal to relay</th></tr><tr><td>0</td><td>0</td><td>…0…</td></tr><tr><td>0</td><td>1</td><td>…0…</td></tr><tr><td>1</td><td>0</td><td>…1…</td></tr><tr><td>1</td><td>1</td><td>…0…</td></tr></table></td><td>all correct<br><br>allow off or no<br>off no<br>on yes<br>off no</td><td>1</td></tr>
<tr><td>(iii)</td><td>(relay) acts as / is a switch<br><br>either<br>small current from the electronic / control circuit / system (1)<br><br>large current through the output / (electric) fire (1)<br><br>or<br><br>full current through electronic control system (1)<br><br>may damage components / lead to overheating / electric shock (1)<br><br>QoWC for correct use of the scientific term ‘current’</td><td>accept implication that it works as a switch e.g. ‘turns on fire’<br><br>or ‘small current through the coil (of the relay)’<br><br>do not accept small current is turned into a large current<br><br>annotate Q✓ Q×<br><br>if answer in terms of voltage isolation / voltage/ p.d. accept QoWC mark for correct use</td><td>1<br><br>1<br><br>1<br><br>1</td></tr>
<tr><td>total</td><td></td><td></td><td>10</td></tr>
</table>

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Science: Double Award 3462/3F
*Specification B*

# Mark Scheme

## *2006 examination - June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

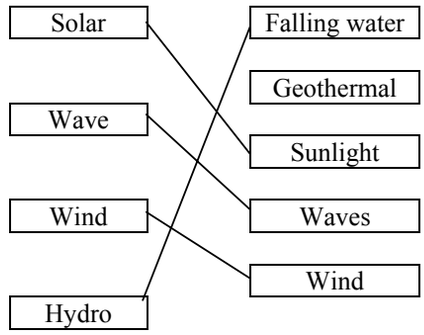
It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

# Double Award (Co-ordinated)
# Foundation Tier 3462/3F

**3462/3F Q1**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 4 correct lines drawn<br><br> | **1** mark for each correct line<br><br>if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines | 4 |
| (b) | 4 | | 1 |
| (c)(i) | nuclear | | 1 |
| (ii) | (natural) gas | do **not** accept natural | 1 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | ultra violet | | 1 |
| (ii) | kill the cells | accept destroys the cells<br>accept makes cells cancerous<br>accept damage cells<br>accept harms cells<br>accept changes DNA<br>accept cause cells to mutate<br>accept skin cells for cells<br>accept cause cancer<br>do **not** accept skin for cells<br>do **not** accept burns the cells | 1 |
| (b)(i) | the sunbed uses an alternating current (a.c.) supply | | 1 |
| (ii) | 10.8 | accept **1** mark for correct substitution of power in W or kW and time in hours or seconds | 2 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q3**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | M | | 1 |
| (ii) | K | | 1 |
| (iii) | J | | 1 |
| (iv) | O | | 1 |
| (b)(i) | billions of years | | 1 |
| (ii) | red giant | any answer in terms of explosion or supernova is **incorrect** | 1 |
| | contracts / shrinks to | incorrect reference to black hole negates **1** mark | 1 |
| | white dwarf | | 1 |
| total | | | 8 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q4**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | A and C | **both** answers must be correct<br><br>in either order | 1 |
| (ii) | A and B | **both** answers must be correct<br><br>in either order | 1 |
| (iii) | same number of protons plus neutrons<br>**or**<br>same number of nucleons | accept number of particles in nucleus the same<br><br>do **not** accept they add up to 6 unless qualified | 1 |
| (b)(i) | any **two** from:<br>• boron - 12<br>• carbon - 14<br>• oxygen - 15<br>• lead - 209 | **both** required<br><br>both name **and** number must be given | 1 |
| (ii) | any **two** from:<br>• boron - 11<br>• carbon - 12<br>• oxygen - 16<br>• lead - 207 | **both** required<br><br>both name **and** number must be given | 1 |
| (c) | alpha | | 1 |
| total | | | 6 |

## 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q5**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | (good) insulator | accept does not conduct (electricity)<br>accept does not conduct heat or electricity<br>do **not** accept does not conduct heat<br>outside is tough is insufficient | 1 |
| (b) | fuse | | 1 |
| (c) | connect the green and yellow / earth wire | accept wires must be connected to screws | 1 |
| | swap the brown and blue wires round | | 1 |
| total | | | 4 |

**3462/3F Q6**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | fossils | answers can be in either order | 1 |
| | water | | 1 |
| (b) | increased | | 1 |
| (c) | radio telescope | | 1 |
| total | | | 4 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q7**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | electrical | | 1 |
| | kinetic | accept movement | 1 |
| (ii) | heat | answers can be in either order | 1 |
| | sound | | 1 |
| (b)(i) | 360 | accept **1** mark for correct substitution | 2 |
| (ii) | watt | | 1 |
| (c) | the stairlift is not moving<br>the stairlift is moving at constant speed | **both** answers are required for the mark | 1 |
| total | | | 8 |

**3462/3F Q8**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | (up) further<br>**or**<br>(up) faster | any reference to downwards movement loses credit<br>accept <u>with</u> more force<br>accept motion would increase | 1 |
| (ii) | down | accept the opposite way<br>accept drop | 1 |
| (b)(i) | direct current | | 1 |
| (ii) | Z | | 1 |
| total | | | 4 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q9**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | level of radiation (detected) will not change | ignore reference to particles | 1 |
| | if thickness of aluminium changes | accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same.<br><br>accept for **1** mark gamma will pass through aluminium | 1 |
| | QoWC for 2 points in a sensible sequence | | 1 |
| (b) | S W T V | all in correct order<br><br>accept **2** marks for 2 correct<br><br>accept **1** mark for 1 correct | 3 |
| total | | | 6 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q10**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 0.05 (A) | ignore incorrect units if given<br>accept 'the same' / 'the same as K' / 'the same as the other ammeter'<br>do **not** accept 'same as the other meter' | 1 |
| (b)(i) | any **two** from:<br>• two cells are joined + to + | answers in terms of current gain no marks<br>accept one cell in the wrong way<br>accept two cells are joined back-to-back<br>accept two cells are joined – to –<br>accept battery for cell<br>do **not** accept answers in terms of all the cells or in terms of energy only | 2 |
| | • some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components | accept voltage for pd<br>do **not** accept using up pd | |
| | • the other components have a resistance | accept a named component / components / wire has a resistance | |
| | • cells not fully charged **or** cells partially run down | do **not** accept voltage of cells is less than 1.5 unless explained<br>do **not** accept cells are not as powerful unless explained | |
| | • cells have an internal resistance | | |
| (ii) | the diode has a (very) high resistance (in the reverse direction) | | 1 |
| | a diode only conducts / allows current to flow in one direction | accept little / no current flows<br>do **not** accept blocks / cuts flow | 1 |

**Continued**

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q10**

| question | answers | extra information | mark |
|---|---|---|---|
| (c) | **QoWC** for the use of the word resistance | annotate Q✓ Q✗<br>accept resistant | 1 |
| | accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral | | |
| | as the pd / current increases / changes | accept voltage for pd<br>must be correctly linked to at least one of the following points accept | 1 |
| | the temperature of the filament increases / changes | lamp / bulb for filament<br>accept filament becomes hotter | 1 |
| | increasing / changing the **resistance** of the lamp | accept for **1** mark only the filament lamp does not obey Ohm's law | 1 |
| total | | | 9 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q11**

| question | answers | extra information | mark |
|---|---|---|---|
| (a) | 0.5 | | 1 |
| | hertz | accept Hz but **not** HZ / hz / hZ<br><br>accept (waves) per second **or** / sec **or** / s **or** $s^{-1}$ **or** $sec^{-1}$ | 1 |
| (b) | any **one** from:<br><br>• any named part of the electromagnetic spectrum<br>• S – waves / secondary waves<br>• wave on a rope | <br><br><br>do **not** accept seismic waves / earthquake<br><br>do **not** accept slinky unless clearly described | 1 |
| (c) | transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel | accept a correctly labelled diagram | 1 |
| | longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel | accept a correctly labelled diagram<br><br>part explanation of the difference between transverse **and** longitudinal gains **1** mark | 1 |
| (d)(i) | TIR shown | needs to stay inside water jet<br><br>ignore number of reflections **or** arrow heads<br><br>lines straight by eye | 1 |
| (ii) | bigger than | any indication of correct answer | 1 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q12**

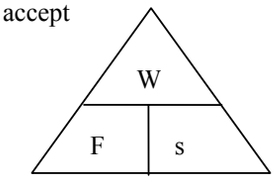
| question | answers | extra information | mark |
|---|---|---|---|
| (a) | W | | 1 |
| | has only two states<br>**or**<br>is either on or off | accept discrete values only<br><br>do **not** credit answer purely in terms of shape | 1 |
| (b) | any **one** from: | | 1 |
| | • higher quality | accept clearer<br><br>do **not** accept easier to read<br><br>ignore faster<br><br>accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength<br><br>do **not** accept no distortion / weakening on its own | |
| | • increased carrying capacity | accept more information can be sent **or** more channels | |
| | • errors can be rectified | | |
| total | | | 3 |

### 4.4.1.2 Mass number, atomic number and isotopes





**3462/3F Q13**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | all points plotted accurately | accept **1** mark for 5 correct plots<br>± ½ small square on stopping distance | 2 |
| | line of best fit must be continuous | accept attempt at a reasonable curve<br>does not need to go through 0 0<br>do **not** accept a straight line<br>do **not** accept dot-to-dot | 1 |
| (ii) | 4 to 6 (metres) | accept ecf from (a)(i)<br>accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown | 2 |
| (b)(i) | 0.7 (s) | incorrect unit = 0 marks | 1 |
| (ii) | constant speed / velocity | accept (continued as) 30mph<br>accept did not change / stayed the same<br>accept no acceleration | 1 |
| (iii) | 3.3(s) | penalise incorrect unit once only | 1 |
| (iv) | reaction time increases / is longer **or** thinking distance increases | do **not** accept reaction time slower **or** reactions are slower | 1 |
| | stopping distance / it increases | do **not** accept travels at constant speed for longer | 1 |
| (c)(i) | work done =<br>force (applied) × distance (moved) | accept W = F × s or W = F × d<br>accept <br>provided subsequent method is correct | 1 |
| (ii) | 2100 | accept 2.1 kilo<br>accept **1** mark for using 7000 N | 2 |
| (iii) | 2100 (joules) | accept their (c)(ii) | 1 |
| total | | | 14 |

### 4.4.1.2 Mass number, atomic number and isotopes



*Science: Double Award (Co-ordinated)* – AQA GCSE Mark Scheme, 2006 June series

**3462/3F Q14**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | refraction | | 1 |
| (ii) | it changes speed<br>**or**<br>change in density | accept it speeds up<br><br>do **not** accept it slows down<br><br>do **not** accept air is more dense than glass | 1 |
| (b)(i) | sound / waves <u>diffract</u><br><br>through the gap (in the wall)<br>**or**<br>over the wall<br>**or**<br>because the gate is open | do **not** accept reflection<br><br>this only scores if first marking point is given<br><br>accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates<br><br>if diagram is labelled as diffraction both marks can be scored | 1<br><br>1 |
| (ii) | less diffraction | accept no diffraction<br><br>accept gates <u>absorb</u> sound / noise / waves<br><br>accept gates <u>reflect</u> sound / noise / waves<br><br>do **not** accept rebounds / stops / blocks out | 1 |
| total | | | 5 |

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Science B 4462 / Physics 4451

## PHY1F Unit Physics 1

# Mark Scheme

*2007 examination - June series*

### 4.4.1.2 Mass number, atomic number and isotopes



Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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*Dr Michael Cresswell*, Director General.

## 4.4.1.2 Mass number, atomic number and isotopes





**MARK SCHEME**

**Information to Examiners**

**1. General**

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

**2. Emboldening**

**2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

**2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.

**2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

**3. Marking points**

**3.1 Marking of lists**

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | 4,8 | 0 |
| 2 | green, 5 | 0 |
| 3 | red*, 5 | 1 |
| 4 | red*, 8 | 0 |

Example 2: Name two planets in the solar system. (2 marks)

| Candidate | Response | Marks awarded |
|---|---|---|
| 1 | Pluto, Mars, Moon | 1 |
| 2 | Pluto, Sun, Mars, Moon | 0 |

**3.2 Use of chemical symbols / formulae**

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

**3.3 Marking procedure for calculations**

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

**3.4 Interpretation of 'it'**

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

**3.5 Errors carried forward**

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

**3.6 Phonetic spelling**

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

**3.7 Brackets**

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

**3.8 Unexpected Correct Answers not in the Mark Scheme**

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 1**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | grid | accept any way of indicating correct answer | 1 |
| (ii) | increases voltage | accept any way of indicating correct answer | 1 |
| (iii) | 230 V | accept any way of indicating correct answer | 1 |
| (iv) | reduce | accept any way of indicating correct answer | 1 |
| (b)(i) | increases the temperature | accept make it hotter / heat goes into the air<br><br>accept convection currents<br><br>accept sensible comment<br>eg sound energy / it buzzes<br><br>ignore pollutes the air | 1 |
| (ii) | less than 100% | | 1 |
| total | | | 6 |

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 2**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | coal | | 1 |
| (b) | fossil fuels can be used to generate electricity at any time<br><br>a few large power stations can generate the electricity for a million homes | if more than 2 boxes ticked, mark incorrect boxes first | 1<br><br>1 |
| (c)(i) | no fuel is burnt | accept a named fuel<br><br>accept nothing is burnt<br><br>accept does not use (fossil) fuel | 1 |
| (ii) | kinetic | | 1 |
| (iii) | any **two** from:<br>• cause <u>noise</u> pollution<br>• cause <u>visual</u> pollution<br>• need concrete for bases<br>• new roads / infrastructure needed<br>• may interfere with TV / radio / mobile phone signals<br>• dangerous to birds<br>• do not generate all of the time<br>• need a lot of generators<br>• high <u>initial</u> / <u>capital</u> costs<br>• reduces house prices | accept causes pollution for **1** mark<br><br>accept generates <u>only</u> when the wind blows<br>do **not** accept 'generate when the wind blows'<br><br>do **not** accept 'take up a lot of space / land' | 2 |
| total | | | 7 |

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 3**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | 7pm | accept 19.00 / 1900 | 1 |
| (ii) | 8pm | accept 20.00 / 2000 | 1 |
| | temperature drops more slowly | accept heat for temperature<br>accept line is less steep | 1 |
| (b) | insulator | | 1 |
| | conduction* | *answers can be either way around | 1 |
| | convection* | | 1 |
| (c)(i) | 4 (years) | | 1 |
| (ii) | it is the cheapest / cheaper / cheap | do **not** accept answers in terms of heat rising or DIY | 1 |
| | has the shortest / shorter payback time | do **not** accept short payback time | 1 |
| total | | | 9 |

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 4**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | any **one** from:<br>• gamma<br>• X-rays<br>• infra red<br>• microwaves<br>• radio | <br>accept correct symbol<br><br>accept IR<br>do **not** accept heat<br><br>do **not** accept TV | 1 |
| (ii) | all the waves travel at the same speed | | 1 |
| (b)(i) | (skin) cancer / melanoma | accept damage eyesight<br>accept sunburn<br>do **not** accept sun tan<br>do **not** accept sunstroke | 1 |
| (ii) | higher levels of UV<br><br>greater risk to health / risk of skin cancer / (more) protection needed / most likely to get burnt / damage skin | accept UV at its strongest / sun's rays are strongest<br>ignore 'sun is at its hottest'<br>ignore 'sun is at its highest'<br>accept greater damage to / easier to damage cells / mutate cells<br>ignore just 'affect your health'<br>must be idea of greater adverse effect on health | 1<br><br>1 |
| total | | | 5 |

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 5**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | C | | 1 |
| (b)(i) | easy to maintain / access<br>**or**<br>(currently) cheaper than a space telescope<br>**or**<br>can modify (easily) an existing telescope<br>**or**<br>telescopes can be larger<br>**or**<br>can test new types of telescope (easily) | do **not** accept 'easier to use'<br><br>do **not** accept easier to supply with power | 1 |
| (ii) | atmosphere does not block / distort the image | accept picture / data for image<br><br>accept 'more detailed / clearer image / data / picture<br><br>accept 'no light pollution'<br><br>accept 'can look at the Earth'<br><br>do **not** accept 'can see further'<br><br>do **not** accept 'better view'<br><br>do **not** accept 'clear view'<br><br>do **not** accept 'can see more clearly' | 1 |
| total | | | 3 |

### 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 6**

| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | electromagnetic (wave / radiation) | accept em (wave / radiation)<br><br>ignore reference to frequency | 1 |
| (ii) | gamma can penetrate the crate / box / packaging | accept converse (but must relate to both alpha and beta)<br><br>ignore just gamma radiation kills bacteria<br><br>accept can get through to food | 1 |
| (iii) | neutrons | | 1 |
| (b)(i) | absorb gamma / radiation | accept it stops / reduces the radiation | 1 |
| (ii) | any **one** from:<br>• slow down the conveyor belt<br>• food does more than one circuit<br>• stay on the conveyor belt longer<br>• food closer to the source / radiation | ignore larger doses / use more of the source<br><br>ignore thinner packaging | 1 |

**Continued on next page**

### 4.4.1.2 Mass number, atomic number and isotopes





**Question 6 continued**

| | answers | extra information | mark |
|---|---|---|---|
| (c)(i) | idea of testing food on humans / animals | | 1 |
| | no (measured) ill effects **or** monitor their health | accept monitor people that have eaten the food<br><br>accept a measurement / comparison for **1** mark<br>eg measure the amount of radiation in treated food<br><br>comparison plus a reason for the comparison would get **2** marks<br><br>eg idea of measuring level of radiation in treated food **with** no measurable increase in level = **2** marks **or** comparing it to untreated food = **2** marks | 1 |
| (ii) | so can make own decision about eating or not eating treated food | accept may be against their religious / moral views<br><br>accept some people prefer food that hasn't been tampered with<br><br>ignore in case they don't like the idea of eating treated food<br><br>accept don't want to eat treated food<br><br>ignore might be allergic to the food<br><br>eg think it will give them cancer = **0** marks<br>think it will give you cancer so I need to know so that I can choose = **1** mark | 1 |
| total | | | 8 |

## 4.4.1.2 Mass number, atomic number and isotopes





**PHY1F Question 7**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | the outside colour of the cans | | 1 |
| (b)(i) | 18 (°C) **or** 88 to 70 | ignore negative sign | 1 |
| (ii) | 8 (°C) **or** 70 to 62 | ignore negative sign | 1 |
| (c) | greater temperature difference between water and surroundings (at start) | must mention temperature difference<br>ignore just water hotter<br>accept energy used to heat cans initially | 1 |
| (d) | black | | 1 |
| | temperature falls the fastest (in L) | accept (can L) loses more heat / cools quicker<br>accept heat for temperature | 1 |
| | black is a good / the best / better emitter (of heat / radiation) | accept converse<br>ignore black is best absorber | 1 |
| total | | | 7 |

4.4.1.2 Mass number, atomic number and isotopes

Answer 41 · Examiner comments

June 2022 | 8463/1F | Original Q4

**Question 4 (Low demand)**

**04.1** About 50% of students correctly identified what an alpha particle consists of.

**04.2** Approximately 40% of students correctly identified what a beta particle is.

**04.3** About 45% of students chose the correct equation for the decay.

**04.4** This question discriminated well with a good spread of marks. A quarter of students scored 3 marks, 40% of students scored 2 marks or more and 70% of students gained 1 mark or more.

**04.5** This question discriminated well with a good spread of marks. About 30% of students scored 3 marks, approcimately 40% of students scored 2 marks or more and about 80% of students scored 1 mark or more.

**04.6** About 75% of students correctly identified the man-made source of background radiation.

**Please note there is no reference to 04.7**

4.4.1.2 Mass number, atomic number and isotopes

**Answer 42 · Examiner comments** June 2023 | 8463/1F | Original Q3

**Question 3 (Low and Standard Demand)**

**03.1** 29% of students scored 2 marks, while 27 % of students scored 1 mark for this question about isotopes..

**03.2** 51% of students knew what half-life means.

**03.3** 77 % of students correctly identified the least stable isoptope.

**03.4** Students found this question difficult with only 38% scoring 2 marks and 21% scoring 1 mark for this question about irradiation and contamination.

**03.5** 68% of students identified the purpose of the sticky floor.

**03.6** 72% of students scored 2 marks on this calculation question.

**03.7** This question discriminated well with 46 % of students scoring 2 marks and 20 % of students scoring 1 mark for this question about fission and fusion

**Answer 43 · Examiner comments** June 2025 | 8463/1F | Original Q3

## 03.1

Almost 70% of the students chose the correct nuclear equation for alpha decay.

## 03.2

The vast majority of the students scored a mark for correctly reading the value on the graph for 50 %.

## 03.3

Just fewer than 40 % of the students scored this mark for identifying the half-life of uranium. Most students did not realise that the two questions, 03.2 and 03.3 were asking for the same value in slightly different ways.

4.4.1.2 Mass number, atomic number and isotopes

Answer 43 · Examiner comments

June 2025 | 8463/1F | Original Q3

## 03.4

A surprisingly large number of the students chose isotope B, scoring no marks. 13 % of the students scored 1 mark for choosing isotope A with an incorrect reason, while 27 % of the students scored 2 marks. A comparison was needed to score the second mark. 'A steep graph' was insufficient, but 'a steeper graph' would have scored the reason mark.

## 03.5

The vast majority of the students chose the nucleus with the smallest mass number correctly.

## 03.6

Just over half of the students chose the correct nucleus with an atomic number of 4.

## 03.7

Students who realised that the nuclei should have the same number of protons generally scored both marks. 'Same amount of protons' was equivalent to 'same number of protons'.

## 03.8

Just over half of the students chose the correct model of the atom.

## 03.9

Nearly 70 % of the students knew that the mass of an atom is concentrated in the nucleus.