

Mark Scheme (Results)  
Summer 2016

Pearson Edexcel GCSE in Physics  
(5PH3F) Paper 01  
Unit: Applications of Physics

## **Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at [www.edexcel.com](http://www.edexcel.com) or [www.btec.co.uk](http://www.btec.co.uk). Alternatively, you can get in touch with us using the details on our contact us page at [www.edexcel.com/contactus](http://www.edexcel.com/contactus).

## **Pearson: helping people progress, everywhere**

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. **We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education.** Find out more about how we can help you and your students at: [www.pearson.com/uk](http://www.pearson.com/uk)

Summer 2016

Publications Code 5PH3F\_01\_1606\_MS

All the material in this publication is copyright

© Pearson Education Ltd 2016

## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be **prepared to award zero marks if the candidate's response is not worthy of credit** according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark **scheme to a candidate's response**, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

## Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question number	Answer	Notes	Marks
1 (a) (i)		<p>each correct line 1 mark</p> <p>two lines from any box on the left loses the mark for that box</p>	(3)

Question number	Answer	Notes	Marks
1 (a) (ii)	<b>D</b> move slower,		(1)

Question number	Answer	Notes	Marks
1 (b) (i)	<b>C</b> 293K		(1)

Question number	Answer	Notes	Marks
1 (b) (ii)	<p>substitution (1)</p> $(T_2) = \frac{0.10 \times (293)}{0.25}$ <p>evaluation (1) 117(K)</p>	<p>Correct substitution of volumes with any temperature Reject 0.25 as a temperature. Reject answers which show squared or cubed volumes</p> <p>accept 120(K), 117.2(K)</p> <p>accept for a maximum of one mark 8(°C), 281(K) 109(K), 128(K), 149(K)</p> <p>Accept correct answer with no working for 2 marks.</p>	(2)

Question number	Answer	Notes	Marks
1 (b) (iii)	Any sensible suggestion such as increasing pressure (inside) (1) increasing the temperature (1) increasing the number of particles (1) heating/warming the balloon (1) reducing pressure outside (1)	Allow 'blowing the balloon up' 'put more air in'	(1)

**Question 1 = 8 marks**

Question number	Answer	Notes	Marks
2 (a)	B 1.8mV		(1)

Question number	Answer	Notes	Marks
2 (b) (i)	substitution (1) $f = \frac{1}{0.46}$ Evaluation (1) 2.2 (Hz)	Ignore additional decimal places  Allow 2.17 (Hz) Condone 2.1 (Hz)	(2)

Question number	Answer	Notes	Marks
2 (b) (ii)	Use of 60 (1)  Evaluation 75 (beats /minute) (1)	Sight of 60 is sufficient  Accept correct answer with no working	(2)

Question number	Answer	Notes	Marks
2 (c)	A suggestion such as: - use of gel / paste (1)  sticking pads to the skin/using sticky pads (1)  shave/clean the skin (1)	Ignore attachments to finger Allow taped(to the skin/body/chest)	(1)

<b>Question number</b>	<b>Answer</b>	<b>Notes</b>	<b>Marks</b>
2 (d)	a description to include any two from sends electrical signals /pulses/shocks (to the patient) (1)  detects heart rate/beats per minute/action potentials (1)  controls/regulates heart rhythm/pattern (1)	Ignore 'measures pulse rate'    Allow 'keeps heart beating properly'	(2)

**Question 2 = 8 marks**

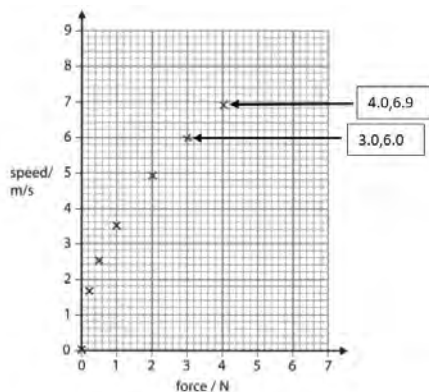
Question number	Answer	Notes	Marks
3 (a) (i)	gravity (1)		(1)

Question number	Answer	Notes	Marks
3 (a) (ii)	friction (1)		(1)

Question number	Answer	Notes	Marks
3 (b) (i)	towards the centre (of the circle) / student /student's head/hand		(1)

Question number	Answer	Notes	Marks
3 (b) (ii)	<b>D</b> pull of the string		(1)

Question number	Answer	Notes	Marks
3(c)(i)	Points 3.00, 6.0 (1) 4.00, 6.9 (1)	Allow +or- one square	(2)





Question number	Answer	Notes	Marks
3 (c) (ii)		<p>Smooth curve through the origin and at least 4 points</p> <p>Ignore extrapolated line.</p> <p>Must not be along the y-axis from the origin</p> <p>No double lines</p>	(1)

Question number	Answer	Notes	Marks
3 (c) (iii)	<p>7.7 + or - 0.5 (m/s)</p> <p>7.2(m/s) to 8.2 (m/s)</p>	Extrapolated curve not required	(1)

Question number	Answer	Notes	Marks
3 (c) (iv)	<p>A description including:</p> <ul style="list-style-type: none"> <li>• as force increases speed increases (1)</li> <li>• not proportional/ speed increases faster for lower forces/rate of change of speed gets smaller (1)</li> </ul>	<p>ORA</p> <p>Allow 'gets faster' for 'speed increases</p> <p>Reject positive correlation and unqualified quoted values</p>	(2)

**Question 3 = 10 marks**

Question number	Answer	Notes	Marks
4 (a) (i)	A are charged		(1)

Question number	Answer	Notes	Marks
4 (a) (ii)	C positrons		(1)

Question number	Answer	Notes	Marks
4 (b) (i)	Rn mass number 222 (1) Rn atomic number 86 (1)	If values reversed allow 1 mark	(2)

Question number	Answer	Notes	Marks
4 (b) (ii)	A statement mass number decreases by 4 (1) atomic number decreases by 2 (1)	Allow for one mark if no other mark scored <b>'both mass number and atomic number decrease'</b>	(2)

Question number	Answer	Notes	Marks
4 (b) (iii)	Description including two of the following neutron becomes a proton (1) atomic number increases by one (1) mass number constant (1) electron emitted (from nucleus) (1)	Allow these points to score within an equation  Do not allow electron emitted from outer shell	(2)

Question number	Answer	Notes	Marks
4 (b)(iv)	An explanation linking two of the following: -  nucleus is not stable / excited / has too much energy/meta-stable (1)  (so)(nucleus) rearranges (1) (by)  losing energy (1) (nucleus) becomes stable (1)	If no other mark awarded allow <b>'gamma has no charge/mass/is a wave/ charge on the nucleus does not change (so emission has no effect on mass number or atomic number)'</b>  Allow mass energy link	(2)

**Question 4 = 10 marks**

Question number	Answer	Notes	Marks
5 (a) (i)	<b>D</b> magnetic		(1)

Question number	Answer	Notes	Marks
5 (a) (ii)	An explanation linking any two of the following: -  (proton/it is) absorbed by (1)  (stable) nucleus/atom/element (1) (to produce)  unstable /radioactive/new { isotopes /nuclei/element} (1)	accept collides with/hits/ bombards    accept new nucleus ignore 'daughter'	(2)

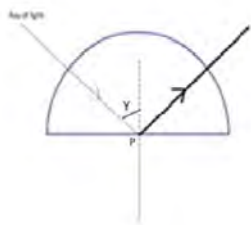
Question number	Answer	Notes	Marks
5 (a) (iii)	neutrons have no charge/ are neutral	Accept' unaffected by magnetic field'	(1)

Question number	Answer	Notes	Marks
5 (b) (i)	Explanation linking two of the following :  high energy / frequency (1)  ionising (1)  destroy cancerous cells (1)  penetrate soft tissue (1)  can be produced in a fine beam (1)	Accept kill/mutate /denature/ionise cells  Accept body for soft tissue  can target/focus on cancerous cells	(2)

Question number	Answer	Marks
5 (b)(ii)*	<p data-bbox="491 241 762 271">Indicative content</p> <p data-bbox="491 315 1166 376">A explanation including some of the following points :-</p> <p data-bbox="491 421 756 450">Safety of patients</p> <ul data-bbox="539 456 1267 696" style="list-style-type: none"><li>• limiting the dosage</li><li>• minimising time of exposure</li><li>• protecting parts of the body not to be treated (using lead covering)</li><li>• finding exactly the position of the tumour</li><li>• using narrow/multiple beam(s) to limit the damage to non-cancerous(good) cells</li></ul> <p data-bbox="491 775 842 804">Safety of radiographers</p> <ul data-bbox="539 810 1222 1088" style="list-style-type: none"><li>• lead aprons</li><li>• operate the X-ray machine from behind a screen</li><li>• stop people entering the room when X-ray machines are being used</li><li>• stay a safe distance away from the X-ray machine</li><li>• check exposure regularly (badges)</li></ul>	(6)

**Question 5 = 12 marks**

Question number	Answer	Notes	Marks
6 (a)	C		(1)

Question number	Answer	Notes	Marks
6 (b)	 <p>total internal reflection (1)</p>	<p>Do not credit answers which show a refracted ray as well as the reflected ray.</p> <p>arrow not required no labelling required</p>	(1)

Question number	Answer	Notes	Marks
6 (c)	<p>An explanation linking two of the following :-</p> <p>speed of light changes (1)</p> <p>slows down (in glass) (1) because</p> <p>glass is (optically) denser (1)</p>	<p>light travels faster in air than in glass (2) ORA</p> <p>allow one mark for refraction if no other marks awarded</p>	(2)

<b>Question number</b>	<b>Answer</b>	<b>Notes</b>	<b>Marks</b>
6 (d)	Substitution (1)  (Power) = $\frac{1}{0.25}$  Evaluation (1) 4.0 (D)	Accept 4 (D)	(2)

Question number	Answer	Notes	Marks
6 (e)*	<p>Indicative content</p> <p>Optical fibre lamp</p> <ul style="list-style-type: none"> <li>• Light comes from a bulb in the base of the lamp</li> <li>• Light travels through the fibres</li> <li>• Light is emitted at the ends of the fibres</li> <li>• (Ideally) no light is lost through the sides of the fibres</li> <li>• Light travels through the fibres by total internal reflection</li> <li>• Diagram showing total internal reflection</li> </ul> <p>Plane mirror</p> <ul style="list-style-type: none"> <li>• Light strikes the mirror</li> <li>• Light is reflected from the surface of the mirror</li> <li>• Angle of incidence is equal to the angle of reflection</li> <li>• Light is reflected to the eye</li> <li>• Shows an image (the person)</li> <li>• Image same size as object</li> <li>• Image is laterally inverted (back to front)</li> <li>• Image is virtual.</li> <li>• Diagram showing reflection from a mirror</li> </ul>	<p>Ignore any reference to LED</p> <p>Labelling not required</p> <p>Labelling not required</p>	(6)



<b>Level</b>	<b>0</b>	No rewardable content
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>• a limited description of at least one of the observations from the effects of light. e.g. light comes out of the end of the fibres / the mirror reflects light</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>• a simple description of one effect OR a limited description of both effects e.g. The light goes through the fibres because of total internal reflection/The mirror reflects light with angle of incidence equal to angle of reflection /The mirror reflects light and light comes out of the ends of the fibres.</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>• a detailed description for BOTH effects e.g. The light travels through the fibres by total internal reflection and the mirror reflects light with the angle of incidence equal to the angle of reflection</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>

**Question 6 = 12 marks**

