edexcel

Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE
Physics (4PH0) Paper 1P
Science Double Award (4SC0) Paper 1P

Pearson Edexcel Level 1/Level 2 Certificate
Physics (KPH0) Paper 1P
Science (Double Award) (KSC0) Paper 1P

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 or 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.

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

Summer 2015
Publications Code UG042407
All the material in this publication is copyright
© Pearson Education Ltd 2015

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.
- 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.

Question number	Answer	Notes	Marks
1 (a)	A - fission		1
(b)	A - absorbing some of the neutrons		1

Total 2 marks

Question number	Answer	Notes	Marks
2 (a) (i)	6 (m/s);		1
(ii)	10 (s);		1
(b) (i)	Acceleration = **change in** velocity / time (taken) ;	allow accepted symbols	1
(ii)	Substitution in correct equation; Evaluation; Unit; e.g. 12 ÷ 10 = 1.2 m/s^2	 ms^{-2} condone m/s/s	3
(c) (i)	(average) speed = distance (moved) / time ;	allow accepted symbols	1
(ii)	Substitution in correct equation; Evaluation; e.g. 390 ÷ 60 6.5 (m/s)	 (388.5 ÷ 60 = 6.475)	2
(d)	MP1 Idea that distance is given by **area** under the graph; MP2 **Comparison** of the two *areas (by eye or by calculation)*;	ignore steepness of lines, velocity, acceleration, width NOTE: a valid comparison that includes MP1 +MP2 gains both marks e.g. the first 30s area is larger than the last 30s	2

Total 11 marks

Question number	Answer	Notes	Marks
3 (a) (i)	C – a fuse		1
(ii)	Idea of independent switching for lamps / rooms;	Allow idea of one bulb blowing but not affecting others idea that bulbs in parallel are bright(er than in series)	1
(b)	MP1. Idea of current changing **direction**; MP2. Continuously;	vary is not enough Allow + and – current Can be shown as a diagram /graph (assume axes labels) Minimum requirement: MP1 shows both + and - (e.g. approximate sine curve) MP2 more than one cycle	2
(c) (i)	Conversion to seconds; Substitution in correct formula; Evaluation; e.g. t = 7 × 3600 (= 25200 s) E = 0.12 × 230 × 7 × 3600 700 000(J)	Allow 3600 or 25200 seen anywhere in working (695520) Correct answer without working scores full marks Accept alternative matching unit e.g. 696 kJ 11592 = 2 marks (time in mins) 193.2 = 2 marks (time in hours) Answer in Wh or Wmin with <u>matching</u> unit scores full marks.	3
(ii)	**B** - same as - less than		1

Total 8 marks

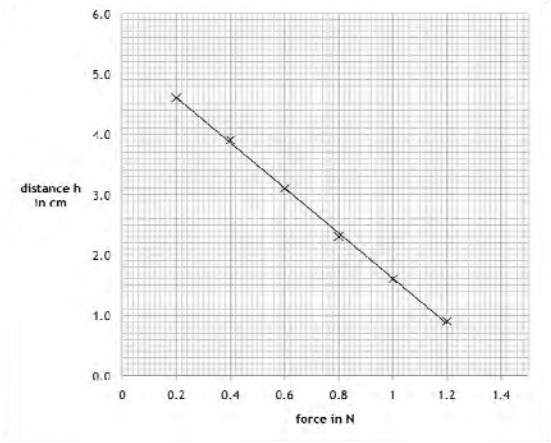
Question number	Answer	Notes	Marks
4	Max of three electrical hazards identified;;; Max of three amplifying details relevant to the hazard(s) identified;;; MP1. Idea of **water** in contact with something electrical e.g. plugs/sockets/switches; MP2. Idea that an electrical device with a heating element reaches a **high temperature**; MP3. Idea that **damaged equipment** poses a hazard; e.g. microwave oven MP4. Idea **overloaded** cables or sockets; MP5. Idea of **trip hazard** from trailing cables;	 Max of 2 amplifications for any one hazard. A repeated amplification can only be credited once e.g. shock, fire, provide plenty of sockets e.g. Idea that water conducts electricity; Idea that this can cause shock; (risk of) burns; idea that insulation can melt and cause a fire; Live parts should not be exposed; Idea that this can cause shock; leaky microwave radiation can cause cancer; circuits should have correct fuses; can cause a fire; don't use multiway socket extensions; provide sufficient sockets; Do not use extension cables; Provide sufficient sockets; Use short mains leads; NOTE	6

	MP6. Idea of **misusing equipment** e.g. sticking metal objects into a socket or exposed heating element;	Appropriate training/safety regime, e.g. use of 'blanks' to cover sockets that children can reach; Idea that this can cause shock; Use proper (insulated) tools;	

Total 6 marks

Question number	Answer	Notes	Marks
5 (a)	Any two of - MP1. mention of no zero error; MP2. Mention that ruler is should be vertical; MP3. use of a fiducial marker; MP4. use of ruler with finer calibrations; MP5. means to reduce parallax; MP6. use of **calliper**;	Ignore (more) accurate ruler e.g. a pin Allow • more detailed ruler • smaller intervals ignore proximity	2
(b) (i)	Distance		1
(ii)	Any two of - MP1. Idea of weight is the force on the mass / W=mg ; MP2. change grams to kilogram; MP3. 1N of force for every 100g; MP4. g is 10 (N/kg);	in any form including numerical Accept ÷ 1000 Ignore ÷ 100 without further explanation Allow idea of gravitational field strength Accept x 10	2

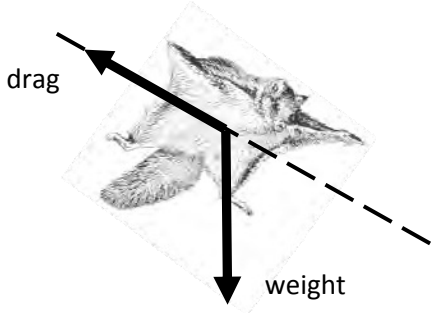
Continued

Question number	Answer	Notes	Marks
5 (b) (iii)	Suitable linear scale chosen (>50% of grid used);	no awkward scale	5
(iv)	Axes labelled with quantities and unit; Plotting correct to nearest half square (minus one for each plotting error);; Line of best fit acceptable;  	Orientation unimportant i.e. two plotting errors = no marks for plotting i.e. straight line Force in N / Distance *h* in cm 0.2 / 4.6 0.4 / 3.9 0.6 / 3.1 0.8 / 2.3 1.0 / 1.6 1.2 / 0.9	
(iv)	straight line seen extended to the force axis; 1.40 ≤ F ≤1.46 (N);	F value to 3 SF unless line goes through 1.40 accept force = 1.4 Answer in range = two marks	2
(v)	NO mark for Yes/No answer Any two of - MP1. Correct statement of Hooke's law; MP2. graph shows equal decrements for distance with force MP3. (line goes down because) different distance has been measured; MP4. graph does not pass through the origin;	Allow **extension** is (directly) proportional to force • equal steps • the line is straight ignore graph is • directly proportional • inversely proportional • negative correlation • the "wrong" distance is measured • extension can be worked out from data • more force = larger extension	2

Total 14 marks

Question number	Answer	Notes	Marks
6 (a) (i)	Any two of: MP1. Idea of marking the line/points; MP2. Idea of moving the compass (to a new point along the line); MP3. Idea of starting a new line from a different place;	accept a labelled diagram allow use of iron filings use a compass allow • tapping paper to line up iron filings • multiple compasses	2
(ii)	Any two of: MP1. Correct shape **only;** MP2. lines not crossing each other; MP3. correct direction arrow shown on at least one line;	all field lines must be correct minimum of two curved lines of correct shape added anywhere in the field reject for MP3 any conflict of arrows	2
(b)	MP1 **all** field lines between the poles shown parallel and straight (by eye); MP2 minimum of 3 straight lines evenly spaced (by eye) between the poles; MP3 Opposite poles shown adjacent;	ignore arrows can only be given if minimum of 2 lines shown	3

Total 7 marks

Question number	Answer	Notes	Marks
7 (a) (i)	gravitational potential energy = mass × g × height	Allow abbreviations e.g. g.p.e. = mgh for g/gravitational field strength reject 'gravity'	1
(ii)	Substitution into correct equation; Evaluation; e.g. g.p.e. = 0.19 × 10 × 17 = 32 (J)	32.3 (J) (or 31.6 J when g = 9.8 ms^{-2}) allow 32300 for 1 mark	2
(iii)	Value same as for (a)(ii)	Allow "the same"	1
(b) (i)	Judge by eye **Weight** shown acting downwards; Drag shown acting against motion;  	NB NO label = no mark Allow abbreviations for labels e.g W, mg ignore gravity	2
(ii)	k.e. = ½ × mass × $velocity^2$	Allow abbreviations e.g. k.e. = ½mv^2	1
(iii)	Substitution into correct equation; Evaluation; e.g. k.e. = ½ × 0.19 × 13^2 = 16 (J)	(16.055) 16055 gets 1 mark	2
(iv)	**A** an unbalanced force acts on the squirrel		1

Total 10 marks

Question number	Answer	Notes	Marks
8 (a)	(Average speed) increases;		1
(b)	Any three of the following ideas-	allow	3
	MP1. Idea of (continuous) random motion; MP2. collide /impacts / eq; MP3. With walls (of balloon); MP4. idea that force is produced (by bombarding molecules); MP5. idea as pressure as force on an area;	 bombard, hit, impact upon momentum argument / N3 p = F/A	
(c)	Any one of the following ideas- MP1. convection (current moves hot air upwards); MP2. hot air/it is less dense;	allow RA ignore hot air rises condone lighter reject for MP2 less dense particles	1
(d) (i)	Density = $\frac{\text{mass}}{\text{volume}}$;	Accept symbols or rearrangement e.g. $\rho = m/V$	1
(ii)	Substitution into correct equation; Rearrangement; Evaluation; e.g. $0.95 = \frac{m}{2800}$ $m = 0.95 \times 2800$ = 2700 (kg)	allow sub and rearrangement in either order 2660	3
(e) (i)	Any one of the following ideas - MP1. atmospheric density decreases as height increases; MP2. depth (from top of atmosphere) decreases; MP3. temperature of air is colder / (cold)molecules move slower;	Allow • number of molecules decreases (from ρ.g.h idea)	1
(ii)	Any one of the following ideas - MP1. air inside/balloon expands; MP2. (hot) air escapes (from the balloon); MP3. hot air (now) cools down / need to use burner;	Allow idea that outside air is cooler at altitude	1

Total 11 marks

Question number	Answer	Notes	Marks
9	Any four of - MP1. either transfer between the two is by conduction; or same SA either way up. MP2. **Infrared** (radiation) mentioned; MP3. Idea of emission of thermal energy; MP4. a correct effect of (surface) colour on emission; MP5. Comparative of surfaces; MP6. correct statement about thermal energy flow at **equilibrium** temperature;	– ignore other comments about conduction, convection , absorption and reflection for thermal energy accept heat or radiation e.g. black emits heat e.g. • black is a good emitter • white is a poor emitter e.g. the black loses more heat than the white	4

Total 4 marks

Question number	Answer	Notes	Marks
10 (a)	**B** galaxy – solar system – Sun – planet		1
(b) (i)	MP1. Idea that (orbit) shapes both (approximately) circular; MP2. Idea that both planets orbit the same star /Sun; MP3. similar plane of orbit; MP4. Same direction of orbit;	accept elliptical, oval, eccentricity Allow "Sun is at centre of orbit"	2
(ii)	different orbital radii ;	Allow • Earth (orbit) radius < Mars orbit radius • different time period • correct reference to speed of orbit • different circumference reject incorrect comparisons	1
(c)	Substitution into correct equation; Evaluation; Answer to two significant figures; e.g. $v = \frac{2 \times \pi \times 23\,500}{1.26}$ (1 mark) = 117 000 (2 marks) =120 000 (km/day) (3 marks)	$2 \pi r / T$ ONLY NO mark for equation as it is given on page 2 Bald correct answer to 3 or more s.f. scores 2 marks, e.g. 117186	3
(d)	MP1. Idea that the **orbital** radii of the two Moons are different; MP2. Idea that **orbit** radius of Enceladus is larger;	Ignore references to gravity ORA NB MP1 will be subsumed within MP2 response e.g orbit radius of Enceladus is ten times as big (ORA) gets both marks Allow response in terms of **orbit** / **orbit** diameter / **orbit** circumference	2

Total 9 marks

Question number	Answer	Notes	Marks
11 (a) (i)	A – electromagnetic waves		1
(ii)	time; for amount of (radioactive) isotope to halve; OR for (radio)activity to halve;	accept how long it takes do not accept 'half of the time' accept for 'amount' (number of un-decayed) nuclei / atoms / molecules / (un-decayed) mass of isotope	2
(b)	Any two of - MP1. (α or β) would have insufficient **range**; MP2. (α or β) would be absorbed by patient/air; MP3. (α or β) are more ionising (than gamma rays);	specific concepts and terminology are needed if the source is external max mark is ONE allow ORA **penetration** ORA stopped by skin / bone Allow (α or β) would be (more) likely to cause cancer/ damages cells (than gamma rays), ORA	2
(c) (i)	Any two of - MP1. Idea that activity is due to **nucleus** decaying; MP2. (after some time) fewer radioactive nuclei /atoms left; MP3. Number (of nuclei) decaying per second decreases;	specific concepts and terminology are needed do not credit repeat of stem Reject for 1 mark. (it/nucleus) breaks down allow • nucleus is unstable • nucleus emits gamma • nucleus changes into new isotope fewer atoms of the same isotope left decay rate decreases	2

(ii)	one halving calculated; Idea of four half-lives / halvings; Evaluation; e.g. (420/2=) 210 for 1 mark 24 ÷ 6 = 4 (half-lives) 26 MBq (26.25)	• 4 repeated halving seen • fraction remaining is 1/16 of activity Allow • four divisions by 2 seen for 2nd mark • remaining fraction = 1/16 = 0.0625 Correct answer without working scores full marks	3

Total 10 marks

Question number	Answer	Notes	Marks
12 (a) (i)	Any two of - MP1. Idea that the reflection is (from a surface) **inside** the material; MP2. Idea that **all** of the light is reflected; MP3. Idea that reflection occurs inside the optically more dense medium; MP4. light incident at angle greater than critical angle	NB do not credit repeat of 'totally', 'internally' within Allow inside the higher refractive index medium	2
(ii)	Any two sensible uses – e.g. • **optical fibres** for communication; • in endoscopes; • **optical fibres** in decorative lamps/eq; • in safety reflector; • (Rectifying) **prism** in binoculars/telescope; • (Viewing) **prism** in camera; • (Reflecting) **prism** in periscope; • (Reflecting) **prism** in rangefinder;	allow only allow bald 'optical fibre' if no other O.F. mark given description of use e.g bicycle/car reflector, cat's eye	2
(b) (i)	**B** - OB		1
(ii)	sin c = 1/n	Allow rearrangements and abbreviations μ for n condone sin i for sin c	1
(iii)	Substitution and rearrangement in correct equation; Evaluation; e.g. n=1/sin 42° = 1/0.6691 n= 1.5	 1.49, 1.50 (1.4945)	2

Total 8 marks

Question number	Answer	Notes	Marks
13 (a) (i)	2 (cm)		1
(ii)	Sketched wave (at least 1 cycle) with a larger amplitude; Sketched wave (at least 1 cycle) with a longer wavelength;	Shape of wave and position of axis unimportant (i.e. ignore conditions of wind and tide)	2
(b)	Any five of -	ignore measurement of distance bald 'clap'	5
	MP1. A method to make a loud enough sound;	• wooden blocks • noise has to heard over 100m	
	MP2. Speed = $\frac{\text{distance}}{\text{time}}$;		
	MP3. Need for still air;	RA	
	MP4. Repeat AND average;	allow repeat AND sort out anomalies	
	MP5. Need to check/reset stopwatch zero reading;		
	MP6. Idea of clear visual signal;	e.g. • when the sound is seen to be made • smoke from starting pistol	
	MP7. measurement of time **interval** (between visual signal and sound);	(because) light travels faster than sound	
	MP8. Idea of reaction time(s) (could be a problem);		

Continued

Question number	Answer	Notes	Marks
13 (c) (i) cont	wave speed = frequency × wavelength	Allow abbreviations and rearrangements, e.g. v=fλ	1
(ii)	Conversion to Hz; Substitution into correct equation and rearrangement; Evaluation; e.g. 31 MHz = 31 000 000 Hz wavelength = 300 000 000 ÷ 31 000 000 9.7 m	Allow 10^6 seen at any stage allow answers which round to 9.7 (9.6774)	3
(d)	Any one of the following ideas - MP1. the two waves travel at different speeds; MP2. the two waves travel the same distance (or 1 wavelength) in different times;	ignore references to • transverse and longitudinal • em spectrum	1

Total 13 marks

Question number	Answer	Notes	Marks
14 (a) (i)	Voltmeter connected in parallel with any circuit component; Component chosen is the thermistor;	Ignore a line through the voltmeter symbol	2
(ii)	(because voltage is) a controlled variable;	Allow idea of fair test	1
(iii)	Any one of - MP1. Idea of adjustment (of current or **circuit** resistance); MP2. To control the current;		1
(b)	Any three of -	however expressed	3
	references to the data: MP1. (yes it works) when the temps are high, the current almost matches the temperature; MP2. (no it's not OK) when the temps are lower, the current value does not match the temperature; MP3. It is only right at 10 (and 100);	e.g. About the same from 80 °C to 100 °C; e.g. not equal at 20mA 20 °C	
	Practicality ideas: MP4. The current cannot be **negative** when the temperature is negative; MP5. Idea that **Voltage** will not be constant/ voltage has to be adjusted to keep it constant;		
	line ideas MP6. Line/ graph is curved /eq;	allow (graph shows that) current not **directly** proportional to temperature	
	MP7. **Line/ graph** does not pass through the origin;	allow 0,0	

Total 7 marks

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom