

Mark Scheme (Results)

Summer 2013

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

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

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. 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 for our BTEC qualifications.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.

Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere

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 2013

Publications Code UG037251

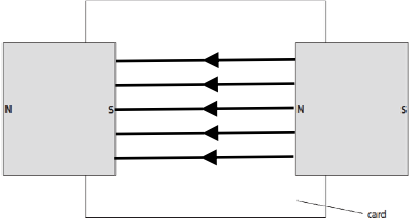
All the material in this publication is copyright

© Pearson Education Ltd 2013

Question number	Answer	Notes	Marks
1 (a) (i)	B - 1 joule per second (1 J/s)		1
	(ii) C - 1 newton per square metre (1 N/m ²)		1
(b) (i)	A - the direction of a magnetic field		1
	(ii) A - has uniform strength		1
		Total	4

Question number	Answer	Notes	Marks						
2 (a)	<table border="1" data-bbox="434 276 1216 470"> <tr> <td data-bbox="434 276 707 373">longest wavelength</td> <td data-bbox="707 276 949 373" style="text-align: center;">→</td> <td data-bbox="949 276 1216 373">shortest wavelength</td> </tr> <tr> <td data-bbox="434 373 707 470">infrared</td> <td data-bbox="707 373 949 470">visible (light)</td> <td data-bbox="949 373 1216 470">ultraviolet</td> </tr> </table>	longest wavelength	→	shortest wavelength	infrared	visible (light)	ultraviolet	<p>All three must be correct for the mark</p> <p>Allow IR for infrared Allow visible (without light) Allow UV for ultraviolet</p>	1
longest wavelength	→	shortest wavelength							
infrared	visible (light)	ultraviolet							
(b)	<p>Any two of:</p> <p>Radio (waves); Microwave(s); x-rays; Gamma (rays);</p>	<p>Allow T-rays</p> <p>γ - rays or γ</p>	2						
(c) (i)	<p>Any two of</p> <ol style="list-style-type: none"> 1. killing bacteria e.g. in water purification OR in hand driers in toilets OR sterilisation of equipment; 2. medical uses e.g. setting dental fillings OR detection of bacteria OR treatment of (named) skin diseases; 3. security markings e.g. for checking banknotes; 4. fluorescent lamp e.g. tanning machines, black-light, detecting blood /other body fluids; 5. data reading e.g. blu-ray devices 	<p>Must be specific, ignore vague answers such as 'used in a hospital', 'for CSI'</p> <p>Allow other sensible suggestions for each MP</p>	2						

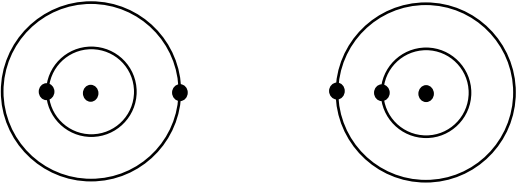
Question number	Answer	Notes	Marks
2 (ii)	Any two of 1. cell damage e.g. (skin) cancer, cell mutation; 2. Sunburn/skin aging; 3. eye damage e.g. cataracts, blindness;	Must be specific, do not allow vague answers such as 'causes burns' 'danger to skin' 'burns skin'	2
		Total	7

Question number	Answer	Notes	Marks
3 (a) (i)	<p>1. at least one arrow showing direction from N to S (right to left);</p> <p>2. one horizontal line between shaded faces;</p> <p>3. minimum of 3 horizontal lines evenly spaced (by eye);</p> <p>e.g.</p>  <p>(ii) 1. a method to show shape; e.g. use compass(es) Use of iron filings/ powder</p> <p>2. Use of (plotting) compass to show direction;</p> <p>3. a further method detail; e.g. mark card /move compass/multiple compasses idea of another line or lines added sprinkle (iron filings evenly on card) tap card (to distribute iron filings)</p>	<p>Reject contradictory arrows</p> <p>For MP2,3 ignore any lines outside the rectangle between the shaded faces</p> <p>allow field lines that almost touch the faces</p> <p>Ignore Position of card /Cling film</p> <p>Ignore pour/place/ drop /spill</p>	<p>3</p> <p>3</p>

Question number	Answer	Notes	Marks
(b)	any two of 1. (Fleming's) Left Hand (Motor) rule OR (current generates) magnetic field around the rod; 2. Idea that there is a force (on rod); 3. (translational) movement of rod; 4. Correct direction given, i.e. out of the paper;	allow LHM rule/LH rule/motor rule/ motor effect Ignore upwards rod is magnetic	2
		Total	8

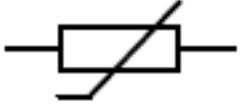
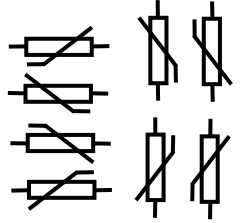
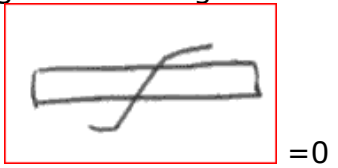
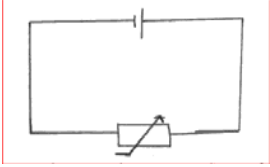
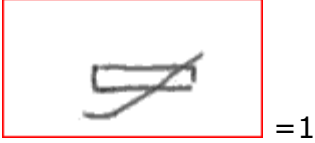
Question number	Answer	Notes	Marks
4 (a)	<p>Student is right / wrong = no mark Any two of</p> <ol style="list-style-type: none"> 1. Balance might not be levelled; 2. zero error; 3. mass could be worn; 4. mass could be mislabelled; 5. value could be within acceptable accuracy of the mass (e.g. $\pm 2\text{g}$); 6. battery of scales is running down/eq; 	<p>Ignore idea of anomaly accept</p> <p>tare, reset error rusty inaccurate marking it rounds to 500 g</p>	2
(b)	<p>Any two of</p> <p>MP1 - Measure/find volume; MP2 - Using a displacement method; MP3 - A sensible experimental precaution e.g. tied to thread OR awareness of meniscus OR repeat readings OR average;</p> <p><i>PLUS</i></p> <p>Any one of</p> <p>MP4 - Formula to use (density = mass \div volume); MP5 - A correct density unit mentioned (e.g. kg/m^3);</p>	<p>For MP2 Ignore calculation of volume geometry</p>	3
		Total	5

Question number	Answer	Notes	Marks
5	<p>Any 5 of</p> <ol style="list-style-type: none"> 1. determine / measure distance; 2. determine / measure time; 3. Appropriate measuring instrument for distance OR time; 4. Use a suitable distance /count laps (of known length); 5. repeat experiment/calculate average; 6. Speed = distance / time OR finding the gradient ; 7. Suitable experimental precaution, e.g. reaction time considered, consistent height on track, time from a predetermined consistent point; 	<p>Allow</p> <p>idea of published track length</p> <p>use of split times</p> <p>e.g. 1 lap or circuit</p> <p>Ignore 'human error'</p>	5
		Total	5

Question number	Answer	Notes	Marks
6 (a)	D – the Sun		1
6 (b) (i)	Substitution; Calculation; $\text{speed} = \frac{2 \times \pi \times 250\,000\,000}{690}$ $= 2\,300\,000 \text{ (km/day) (correct to 2SF)}$	If answer given to more than 2SF, then allow range of 2 275 000 → 2 280 000 max 1 for POT error in bald answer Accept appropriate labelled diagrams Allow for one mark: elliptical if no other mark scored e.g, orbit of Mars is more elliptical than Earth's	2
6 (b) (ii)	Any two of 1. Idea of different speeds; 2. idea of different orbits /radii; 3. Idea of variable relative motion, e.g. both on the same side of the Sun and then on opposite sides of the Sun; 4. Appropriate calculation e.g. difference or sum of radii, attempt to calculate speed of Earth; e.g. Diagram showing understanding of MP2 and MP3 	ignore Mars labelled inside Earth's orbit	2

Question number	Answer	Notes	Marks
6 (c) (i)	<p>Working;; e.g.</p> $300\,000 = \frac{170\,000\,000}{t} \quad 1 \text{ working mark (sub ONLY)}$ $t = \frac{170\,000\,000}{300\,000} \quad \text{both working marks (sub AND rearrange)}$ <p>Calculation; e.g.</p> $= 570 \text{ (566.7) (s)} \quad 1 \text{ mark (ans to } > 1 \text{ SF)}$	<p>'show that' question, working must be shown for full marks</p> <p>REVERSE CALCS: maximum mark =2 (correct calc plus a comparison statement e.g. $283\,333 \approx 300\,000$ $180\,000\,000 \approx 170\,000\,000$)</p> <p>Allow (without the subject of the equation) for 2 marks, <u>170 000 000</u> 300 000</p>	3

Question number	Answer	Notes	Marks
6 (c) (ii)	<p>Any two of</p> <ol style="list-style-type: none"> 1. IDEA of HOW THE LOW SPEED AFFECTS DRIVING; low speed reduces stopping distance low speed helps to avoid obstacle 2. IDEA of THE EFFECT OF LOW SPEED ON COLLISION; momentum /low speed / low (kinetic) energy reduces damage if in collision 3. IDEA of WHAT THE TIME DELAY DOES; time delay affecting reaction time / stopping distance / steering 4. IDEA of WHAT THE TIME (DELAY) IS; it takes a long time to get the signal (the communication delay is) ≈ 1200 (s) (we see images which are) 600s delayed light and radio waves travel at the same speed in a vacuum 	<p>Allow idea that rover could travel up to 48 m between commands RA</p> <p>ignore better photos/detail of the planet /eq</p>	2
		Total	10

Question number	Answer	Notes	Marks
7 (a)	 <p>Symbol can be in any orientation, e.g.</p> 	<p>the line through the rectangle must be correct</p>  <p>Ignore the size Ignore the rest of the circuit</p>  <p>e.g. =0 as the line through is incorrect</p> <p>Allow without the connection leads</p>  <p>=1</p>	1
(b)	<p>(i) Voltage = current x resistance;</p> <p>(ii) Convert milliamps to amps OR kilo-ohms to ohms; Substitution into <i>correct</i> equation & rearrangement; Calculation to greater than 1SF;</p> <p>2.6 mA = 0.0026 A</p> $(R) = \frac{13.2}{0.0026}$ $= 5077 (\Omega)$	<p>Allow $V = IR$ Allow rearrangements ignore a bald 'triangle'</p> <p>'show that' question, working must be shown for full mark</p> <p>Allow 5080, 5076 (truncation) 5.080 with working is worth 2 marks 5.08 with no working is worth 1 mark</p>	1 3

Question number	Answer	Notes	Marks
7 (c)	<p>Any five of <i>ABOUT A</i></p> <ol style="list-style-type: none"> 1. Resistance of A decreases with temperature; 2. For A, {largest slope / rate of change} is at lower temperature ORA {smallest slope /rate of change} is at higher temperature; 3. A is a thermistor (ntc); <p><i>ABOUT B</i></p> <ol style="list-style-type: none"> 4. Resistance of B increases with temperature; 5. For B, {largest slope / rate of change} is at higher temperature(s) ORA {smallest slope /rate of change} is at lower temperature; 6. For B, resistance is constant below 50 °C; <p><i>ABOUT BOTH</i></p> <ol style="list-style-type: none"> 7. More results for B/ fewer results for A; 8. stated both relationships are non-linear; 9. Range of (temperature/resistance) values for both is similar; 10.data comparison e.g. both have the same resistance at 80 °C; 	<p>Accept</p> <ul style="list-style-type: none"> • (MP1) for A, when the temperature is low, the resistance is high, ORA • (MP4) for B, when the temperature is low, the resistance is low, ORA <p>Allow component B is a ptc thermistor ORA Up to 60 °C</p> <p>Ignore: inversely proportional positive/negative correlation</p> <p>Do not take implication of MP8 when MP 1,2,4,5 is given</p>	5
		Total	10

Question number	Answer	Notes	Marks
8 (a) (i)	work done = force x distance moved ;	Accept $W = F \times d$ Allow rearrangements do not accept eqn in units only	1
(ii)	Substitution into correct equation; Calculation; 170 x 110 19 000 (J)		2
(iii)	exactly same as their answer to (ii);	Accept 18 700 (J)	1

Question number	Answer	Notes	Marks
8 (b) (i)	$KE = \frac{1}{2}mv^2$	Accept word equation	1
(ii)	addition of masses before OR addition of energies after; Substitution into correct equation; Calculation; $1650 + 950 = 2600$ (OR $436\,425 + 251\,275 = 687\,700$) $\frac{1}{2} \times 2600 \times 23^2$ 688 000	Accept for 1 mark - either 436 000 or 251 000 accept for 2 marks - both 436 000 and 251 000 Accept for 3 marks- 687 700	3
(c)	Any three of 1. idea that mass and acceleration are inversely related; 2. Idea that (total) mass is less; 3. Idea of less (air) resistance / friction; 4. Idea of less work done/less energy used; 5. Idea of amount work related to amount of (chemical) energy from fuel;	allow $F = m \times a$ mentioned weight for mass drag doesn't have to use energy to pull the caravan	3
		Total	11

Question number	Answer	Notes	Marks
9 (a)	Any two of 1. ruler has a mm scale ; 2. idea of inappropriate precision; 3. paper is (very) thin;	ignore vague statements e.g. the ruler is too big allow scale is too big paper is thinner than 1 mm	2
(b) (i)	C 0.1 mm		1
(ii)	Any two of 1. parallax error; 2. gap left between ruler and paper; 3. ruler not perpendicular; 4. zero error;	allow <ul style="list-style-type: none"> • misreading or inaccurate reading of the ruler • damaged ruler • top sheet not flat ignore air gaps between sheets folded paper miscounting sheets different sizes of paper incorrect recording of measurements need for more precise instrument human error	2

Question number	Answer	Notes	Marks
(c) (i)	<p>An explanation including any 2 of</p> <p>1. acceleration needs an unbalanced force;</p> <p>2. (constant velocity means) the aeroplane is not accelerating;</p> <p>3. idea of absence of unbalanced/overall force;</p>	<p>ignore idea that the forces are acting at different points on the plane</p> <p>allow Newton I or Newton II unbalanced forces cause acceleration /deceleration / change of <i>velocity</i></p> <p>flying straight or not changing speed /direction</p> <p>'no resultant force' statement that there is a suitable pair of named balanced forces</p>	2
(ii)	<p>weight arrow vertically down; lift arrow upwards; drag arrow to the left;</p>	<p>allow labelled arrows anywhere on the diagram</p> <p>vertical to 45deg to the right inside the angle of the plane wings</p>	3
(iii)	<p>lost as (/dissipated to) heat, sound etc</p>	<p>allow lost to the surroundings/air absorbed by surroundings/air ignore kinetic energy 'other types of energy'</p>	1
		Total	11

Question number	Answer	Notes	Marks
10 (a) (i)	42 (m/s)	Allow range 42 - 43	1
	(ii) Attempt to calculate slope; Answer; Unit; $42 \div 15$ 2.8 m/s^2	Allow value from (i) e.g. $43 \text{ m/s} \rightarrow 2.9 \text{ m/s}^2$ $42.5 \rightarrow 2.83 \text{ m/s}^2$ $45 \rightarrow 3 \text{ m/s}^2$ not $42/120$ allow $42/20$	3
	(iii) Attempt to calculate an area under graph line; Appropriate further working (e.g. adding areas); Answer; $(\frac{1}{2} \times 15 \times 42) + (80 \times 42) + (\frac{1}{2} \times 25 \times 42)$ $315 + 3360 + 525$ 4200 (m)	Allow value from (i) e.g. $43 \text{ m/s} \rightarrow 4300 \text{ m}$ first 2 MP may be gained using the trapezium method, i.e. $42 \times (120+80)/2$ Bald correct answer scores 3	3

Question number	Answer	Notes	Marks
(b)	Any three from 1. Stopping distance affected by speed or mass; 2. For faster plane, stopping distance greater/ runway too short ; 3. for heavier plane stopping distance greater/ runway too short; 4. Attempt to calculate stopping distance from graph; 5. Data shows most/all of runway already used;	ignore time = $500/40$ Allow a momentum argument for MP1, 2, 3	3
		Total	10

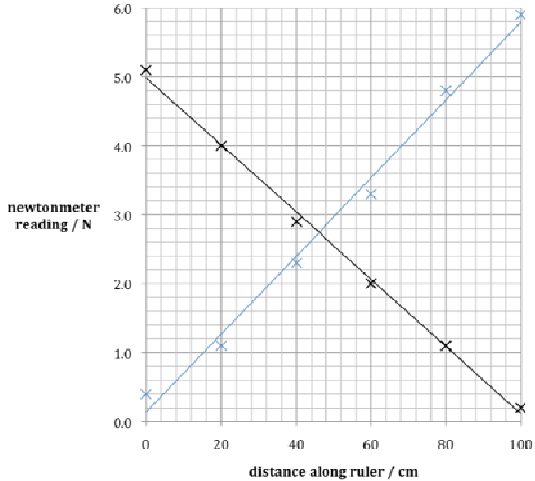
Question number	Answer	Notes	Marks
11 (a)	Idea of (correct) change of speed OR wavelength; (Refractive) index / (optical) density of glass > that of air (ORA);	Allow for 1 mark speed slower in glass OR wavelength shorter in glass (ORA) allow RI, n for refractive index	2
(b) (i)	$\sin c = 1/n$;	Allow rearrangements ($n = 1/\sin c$) in words (incl critical angle)	1

Question number	Answer	Notes	Marks
11	<p>(ii) $(n=) 1/\sin 43$ OR $\sin 43^\circ = 0.682$; $n = 1.47 (\approx 1.5)$;</p> <p>(iii) Any three of</p> <ol style="list-style-type: none"> 1. larger RI means smaller c ; 2. TIR when $i > c$; 3. for diamond larger range of angles for TIR ; 4. Some appropriate calculation, e.g. for diamond $c = 25^\circ$; 5. 43° to 90° for TIR in opal; 	<p>(0.68199836) (1.466279) Refractive index must be shown to > 2 sig fig Allow truncated values Reverse calculation can score 1 mark Reverse calculation with comparison can score both marks Bald answer can score 1 mark</p> <p>allow</p> <p>c is smaller in diamond</p> <p>TIR happens at angles smaller than in opal/43° ($1/2.4 = 0.417 \rightarrow c=24.6^\circ$)</p> <p>Accept for 2 marks 25° to 90° for TIR in diamond; (MP2,4)</p> <p>Ignore more of the rays going TIR (repeat of stem) diamond has a higher RI than opal</p>	<p>1</p> <p>2</p> <p>3</p>
		Total	8

Question number	Answer			Notes	Marks
12 (a) (i)	Isotope	Proton number	Neutron number		2
	Uranium-234	92	142		
	Uranium-235	92	143		
	Uranium-238	92	146		
	92 as shown; 146 as show;				
	(ii)	Time taken; and either of <ul style="list-style-type: none"> For half of (radioactive) nuclei / atoms /isotope to decay; For (radio)activity to halve;		Reject for the relevant mark 'half the time' particles molecules 'break down' 'reactivity' nucleus halve in mass to completely/fully decay	2
	(iii)	any one from: <ul style="list-style-type: none"> Other isotopes have decayed more quickly; It has the longest half-life; 		Allow how long it takes Allow <ul style="list-style-type: none"> reverse arguments comparative e.g. longer rather than longest Ignore <ul style="list-style-type: none"> number of neutrons purity /concentration	1

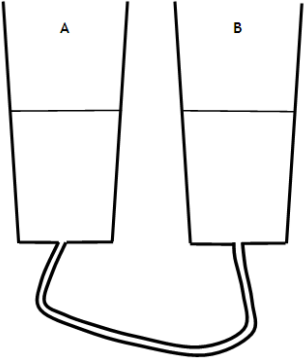
Question number	Answer	Notes	Marks
12 (b)	any three from 1. Neutrons; 2. (product) nuclei/a named nucleus; 3. Appropriate qualification of either term above(DOP); 4. gamma (radiation)/thermal energy e.g. of MP3 neutrons - 2, 3, fast, high energy nuclei – daughter, lighter, e.g. for MP2 allowed nuclei include : krypton, barium, xenon,	Allow two correct named nuclei as MP2 & MP3 Ignore extra as a qualifier for neutrons helium alpha beta atoms daughter atoms/cells	3
(c) (i)	Any one of to slow down neutrons/eq; to increase rate of fission; to increase absorption of neutrons by uranium/fuel;	allow reduce the (kinetic) energy of neutrons	1
(ii)	Any two of 1. rate of reaction increases; 2. fewer neutrons absorbed by control rod OR more neutrons collide with uranium; 3. temperature <u>increases</u> ;	allow rate of fission increases control rods absorb neutrons <u>more</u> heat released (need for comparative) ignore risk of explosion	2

Question number	Answer	Notes	Marks
12 (d)	<p>Any five of the following ideas</p> <p><i>facts about radioactivity</i></p> <ol style="list-style-type: none"> 1. idea of harmful nature of radiation / danger to life; 2. high (activity) levels; 3. long half-life / half-lives; <p><i>consequences</i></p> <ol style="list-style-type: none"> 4. difficulties for (emergency) workers to access the area, e.g. short safe working times / need for protective clothing; 5. (requirement for) special handling equipment OR difficulty in removing material; 6. idea of extensive time OR distance (exclusion/hazardous) zone; <p><i>environmental effects local and distant</i></p> <ol style="list-style-type: none"> 7. idea of radioactive material mixing with the local environment e.g. soil, plants, water, air; <p>idea of further /more distant spreading of material e.g. by fire, wind, water;</p>	<p>Ignore repeat of the stem, i.e. radioactive material has been spread into the surrounding area can't be seen</p> <p>allow MP1 toxic, can kill, causes mutation, ionises cells</p> <p>MP5 a lot of (contaminated) material to deal with</p> <p>MP6 still radioactive after a long time takes a long time to go away</p>	5
		Total	16

Question number	Answer	Notes	Marks												
13 (a) (i)	A – distance A		1												
(ii)	D – force D		1												
(b) (i)	Force (C) in N; or Force in newtons;	Allow: Reading from newton-meter in N	1												
(ii)	Plotting ;; Line of best fit;  <table border="1" data-bbox="1093 596 1285 839"> <tbody> <tr> <td>0</td> <td>5.1</td> </tr> <tr> <td>20</td> <td>4.0</td> </tr> <tr> <td>40</td> <td>2.9</td> </tr> <tr> <td>60</td> <td>2.0</td> </tr> <tr> <td>80</td> <td>1.1</td> </tr> <tr> <td>100</td> <td>0.2</td> </tr> </tbody> </table>	0	5.1	20	4.0	40	2.9	60	2.0	80	1.1	100	0.2	To nearest ½ square, penalise errors up to two marks Suited to candidate's plotting (allow a smooth curve) no double lines judge LoBF by balance of points about the line	3
0	5.1														
20	4.0														
40	2.9														
60	2.0														
80	1.1														
100	0.2														
(iii)	Reading from graph to ± 1 cm; e.g. 46	To nearest ½ small square	1												

Question number	Answer	Notes	Marks
13 (c)	weight of ruler;	Accept other valid reasons allow force for weight ignore 'it's got a force acting' 'because of gravity'	1
		Total	8

Question number	Answer	Notes	Marks
14 (a) (i)	pressure difference = height x density x g	Accept $P = h\rho g$ $P = h d g$	1
	(ii) Substitution into correct equation; Calculation; $0.91 \times 1000 \times 10$ 9100 Pa	correct answer with no working scores 2 marks Accept: <ul style="list-style-type: none"> • 9.1 kPa • 8918 Pa (from $g = 9.8 \text{ m/s}^2$) • 8927 Pa (from $g = 9.81 \text{ m/s}^2$) • h in cm / 910 000 Pa for a max of 1 	2

Question number	Answer	Notes	Marks
14 (b) (i)	 <p data-bbox="425 558 1041 590">the water level is the same on both sides</p>	allow some wobbles on the B side area shaded	1
	<p data-bbox="347 694 918 734">(ii) Any three of the following ideas</p> <ol data-bbox="425 774 1220 1165" style="list-style-type: none"> 1. pressure difference (relating to flow); 2. pressure equality (relating to flow ending); 3. reference to relevant pressure equation ; e.g. pressure causes force on water, pressure = force / area pressure = $h\rho g$; 4. (more) gravitational potential energy (in A) /ORA; (fluid) <u>pressure</u> acts in all directions; 	<p data-bbox="1355 694 1769 829">Allow force or weight instead of pressure for either MP1 OR MP2 but not both</p> <p data-bbox="1355 949 1736 1085">MP3 allow 'pressure pushes water' 'height difference pushes water'</p>	3
		Total	7
		Total for paper	120

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467

Fax 01623 450481

Email publication.orders@edexcel.com

Order Code UG037251 Summer 2013

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

Ofqual




Llywodraeth Cynulliad Cymru
Welsh Assembly Government

