**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

**PHYSICS** **0625/31**

Paper 3 Core Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.



This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

M marks — are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.

B marks — are independent marks, which do not depend on other marks. For a B mark to scored, the point to which it refers must be seen specifically in the candidate's answers.

A marks — In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks — are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows that they knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.

Brackets ( ) — around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

Underlining — indicates that this must be seen in the answer offered, or something very similar.

OR / or — indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o. — means "each error or omission".

o.w.t.t.e. — means "or words to that effect".

Ignore — indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

Spelling — Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities: e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not/NOT — indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.

| | |
|---|---|
| e.c.f. | meaning “error carried forward” and is mainly applicable to numerical questions, but may occasionally be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by e.c.f. may be awarded, provided the subsequent working is correct, bearing in mind the earlier error. |
| Significant figures | Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme. |
| Units | Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question. |
| Arithmetic errors | Deduct only one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic one. |
| Fractions | Only accept these where specified in the mark scheme. |

| Question | Expected answer | Mark |
|---|---|---|
| 1(a) | 0 and 5 | **B1** |
| 1(b) | distance = area under (speed-time)graph **or** distance = speed × time<br>8 × 15<br>120 (m) | **C1**<br>**C1**<br>**A1** |
| 1(c)(i) | middle box ticked B | **B1** |
| 1(c)(ii) | cyclist is moving with zero acceleration<br><br>(so) forward force must be same as backward force | **B1**<br><br>**B1** |
| | **Total:** | **7** |

| Question | Expected answer | Mark |
|---|---|---|
| 2(a) | 3.5<br>4.3 | **B1**<br>**B1** |
| 2(b) | any 2 from:<br>ruler with mm scale<br>ruler vertical o.w.t.t.e.<br>ruler next OR behind to elastic<br>use of fiducial marker o.w.t.t.e.<br>have eye level (with reading) | **B2** |
| 2(c)(i) | top line labelled B – bottom line labelled A<br>AND<br>statement linked to readings for A<br>OR<br>idea that B will stretch more than A | **B1** |
| 2(c)(ii) | straight line (by eye) steeper than line for B, through origin | **B1** |
| | **Total:** | **6** |

| Question | Expected answer | Mark |
|---|---|---|
| 3(a) | arrow drawn vertically upwards (by eye) | **B1** |
| | arrow positioned beyond RH support | **B1** |
| 3(b) | moment = force × (perp.) distance from pivot or 200 × 2.0 | **C1** |
| | 400 (Nm) | **A1** |
| 3(c) | sum of Clockwise moments = sum of Anticlockwise moments<br>**OR** 400 = W × 0.50 **OR** 400 / 0.50 | **C1** |
| | 800 (N) | **A1** |
| | **Total:** | **6** |

| Question | Expected answer | Mark |
|---|---|---|
| 4(a)(i) | (gravitational) potential (energy) | **B1** |
| 4(a)(ii) | increases the temperature | **B1** |
| 4(a)(iii) | The total energy (of a system) remains constant **OR** energy cannot be created or destroyed o.w.t.t.e.<br><br>100 J = 80 J + 20 J **OR** <u>all</u> of the input energy is stored as PE or in the surroundings (as thermal energy) | **B1**<br><br>**B1** |
| 4(b) | any 2 benefits from:<br>reliable supply of electricity<br>large amount of (electrical) energy produced / power output<br>plentiful supply of fuel<br>one of cheapest methods of generating electricity<br><br>any 2 problems from:<br>non-renewable (energy source) **OR** use up earth's resources<br>greenhouse gases / carbon dioxide produced / increases global warming<br>contributes to <u>atmospheric</u> pollution / acid rain | **B2**<br><br>**B2** |
| | **Total:** | **8** |

| Question | Expected answer | Mark |
|---|---|---|
| 5(a)(i) | refraction | **B1** |
| 5(a)(ii) | ray travels un-deviated through curved surface<br>ray reflected with i = r by eye | **B1**<br>**B1** |
| 5(b)(i) | ray drawn from headlight to hit middle shop and<br>reflected towards X | **B1** |
| 5(b)(ii) | angle of reflection = angle of incidence | **B1** |
| 5(b)(iii) | normal drawn at point of incidence on window<br>angles of incidence and reflection correctly labelled | **B1**<br>**B1** |
| | **Total:** | **7** |

| Question | Expected answer | Mark |
|---|---|---|
| 6(a) | molecules are closer in water **OR** molecules are further apart in water vapour<br>randomly arranged<br>moving randomly | **B3** |
| 6(b) | more energetic particles **OR** particles near the surface are moving in correct direction<br><br>overcome force of attraction (in surface)<br><br>(process) Evaporation | **B1**<br><br>**B1**<br><br>**B1** |
| 6(c) | P = F / A<br>5.6 / 140<br>0.040 ($N / cm^2$) | **C1**<br>**C1**<br>**A1** |
| | **Total:** | **9** |

| Question | Expected answer | Mark |
|---|---|---|
| 7(a) | ultraviolet | **B1** |
| 7(b) | microwaves | **B1** |
| 7(c) | middle box ticked | **B1** |
| 7(d) | ANY ONE from<br>(sound waves are) longitudinal OR compression waves<br>cannot travel through a vacuum<br>move at much slower speed | **B1** |
| | **Total:** | **4** |

| Question | Expected answer | Mark |
|---|---|---|
| 8(a) | A in circle in series with wire | **B1** |
| | V in circle in parallel with wire | **B1** |
| 8(b) | V = I R **OR** (R =) V / I<br>6.0 / 0.2<br>30 (Ω) | **C1**<br>**C1**<br>**A1** |
| 8(c) | current is smaller (in 2nd wire) | **B1** |
| | (as) resistance is greater (in 2nd wire) | **B1** |
| | **Total:** | **7** |

| Question | Expected answer | Mark |
|---|---|---|
| 9(a) | (laminated) iron | **B1** |
| 9(b)(i) | $(V_p / V_s)$ = $(N_p / N_s)$ in any form<br>$240 / V_s$ = 36 000 / 900 or $V_s$ = 240 / 40<br>6.0 (V) | **C1**<br>**C1**<br>**A1** |
| 9(b)(ii) | step-down (transformer because) there are fewer turns on secondary (compared to primary coil) OR the output voltage is smaller than the input voltage | **B1** |
| 9(c) | Any 2 from:<br>less energy or power wasted or less heating or more efficient<br><br>accept lower current<br>can use thinner (transmission) wires or cables<br>fewer power stations needed<br>(so) lower cost for cable and supporting pylons<br>transmit (electricity over) longer distances (without drop in power) | **B2** |
| | **Total:** | **7** |

| Question | Expected answer | Mark |
|---|---|---|
| 10(a)(i) | attractive force ringed | **B1** |
| 10(b)(i) | (end A ) N / north(seeking) **AND** (end B ) S / south(seeking) | **B1** |
| 10(b)(ii) | at least two field lines drawn above AB<br>at least two field lines below AB | **B1**<br>**B1** |
| 10(b)(iii) | at least one arrow towards B ecf from bi | **B1** |
| 10(c) | (it / electromagnet) can be switched off / on<br>strength of electromagnet can be changed (by varying current in coil) | **B1**<br>**B1** |
| | **Total:** | **7** |

| Question | Expected answer | Mark |
|---|---|---|
| 11(a)(i) | (arrange) magnets with opposite poles facing<br>connect (ends of) wire across / to millivoltmeter<br>move wire between poles | **B3** |
| 11(a)(ii) | deflection on meter (as wire moves between poles) | **B1** |
| 11(a)(iii) | any **two** from:<br>wrap wire into (more) coils<br>move wire / magnet faster<br>use stronger magnets<br>move (poles of) magnets closer together | **B2** |
| | **Total:** | **6** |

| Question | Expected answer | Mark |
|---|---|---|
| 12(a) | <table><tr><th>(type of particle)</th><th>(number of particles)</th></tr><tr><td>PROTON</td><td>55</td></tr><tr><td>NEUTRON</td><td>82</td></tr></table> | B2<br>B2 |
| 12(b) | (nucleus has)<br>same number protons<br><br>different number of neutrons | B1<br><br>B1 |
| | **Total:** | **6** |