# MARK SCHEME for the October/November 2014 series

## 0625 PHYSICS

| 0625/33 | Paper 3 (Extended Theory), maximum raw mark 80 |

## NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

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

M marks    M marks are method marks upon which accuracy marks (A marks) later 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 A marks can be scored.

C marks    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 he 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.

A marks    A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly 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. An A mark following an M mark is a dependent mark.

Brackets ( )    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    Underlining indicates that this **must** be seen in the answer offered, or something very similar.

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

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

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

Ignore    This 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, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not / NOT    This 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.

ecf            meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances 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 ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Sig. figs.     Answers are normally acceptable to any number of significant figures ≥ 2. Any exceptions to this general rule will be specified in the mark scheme. Rounding errors in the second or third significant figure will be penalised.

Arithmetic errors
               Deduct 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 error.

Transcription errors
               Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.

Fractions      Allow fractions only where specified in the mark scheme.

Units          Deduct one mark for an incorrect or missing unit, but only if the answer would otherwise have gained all the marks available for that answer. Maximum one unit penalty per question.

**1** **(a) (i)** (gradient =) 10 (m/s$^2$)       B1

     **(ii)** any linking of gradient to acceleration of freefall **OR** gravitational field
strength       B1

  **(b)** gradient decreases       B1

  **(c)** speed/velocity stays constant **OR** terminal velocity/speed       B1
     no resultant force **OR** forces cancel/balance       B1

  **(d)** initially gradient steeper       B1
     graph lower in second half of BC       B1
     horizontal final section **and** lower than CD       B1

                                                          **[Total: 8]**

**2** **(a) (i)** 180 N       B1

     **(ii)** ($P =$) $F \div A$ **OR** 180÷(0.30 × 0.04)       C1
         15 000 Pa       A1

  **(b) (i)** arrow (labelled $W$) from/to correct centre of mass       B1

     **(ii)** **1.** force × (perpendicular) distance **OR** 40 × 0.60 **OR** 180 × 0.15 in **2.**       C1
        24 N m       A1

        **2.** 27 N m                                         e.c.f. from **(a)(i)**       A1

     **(iii)** slab topples/rotates (about point D) **OR** corner C lifts from ground
        **OR** falls over       B1

        <u>moment</u> of force at B becomes bigger than <u>moment</u> of weight / W
        **OR** anticlockwise <u>moment</u> becomes bigger than clockwise <u>moment</u>
        **OR** weight/centre of mass outside base       B1

                                                          **[Total: 9]**

**3** **(a) (i)** (g.p.e. =) $mgh$ **OR** 0.15 × 10 × 1.8       C1
        2.7 J ignore minus sign       A1

     **(ii)** (k.e. **OR** 2.7 =) ½$mv^2$ **OR** ½ × 0.15$v^2$       C1
        ($v^2$ =) 36       C1
        6.0 m/s       A1

**(b) (i)** <u>initial</u> temperature (of metal) **OR** <u>final</u> temperature (of metal)
**OR** temperature change (of metal)    B1

**(ii)** thermal energy transferred to something specific e.g. air / tube / stopper /
thermometer / surroundings / environment
**OR** small spheres lost before / after weighing
**OR** not all the spheres fall the same distance    B1

**(iii)** higher temperature increase **OR** calculate mean of (100) readings    M1
small measurements less accurate owtte    A1

[Total: 9]

**4 (a)** $pV$ = constant **OR** $p_1V_1 = p_2V_2$ **OR** $p_1V_1 / V_2$ or $1.0 \times 10^5 \times 100 \div 40$    C1
$2.5 \times 10^5$ Pa    A1

**(b) (i)** (the particles move) <u>randomly</u>    B1

(the particles move) slowly **OR** through small distances **OR** disappear **OR**
zigzag **OR** directions change **OR** erratic **OR** straight lines between collisions    B1

**(ii)** air <u>molecules</u> / <u>particles</u> collide with smoke particles (at high speed)    B1
fast(er) air molecules **OR** move randomly **OR** many collisions    B1

**(c)** diagram showing:
<u>molecules</u> touching each other    B1
<u>molecules</u> positioned in an ordered structure    B1

[Total: 8]

**5 (a)** ($n$ =) sin $i$ / sin $r$ **OR** sin 62 / sin 36    C1
1.5(02)    C1
($v_g$ =) c / n **OR** $3.0 \times 10^8$ / 1.5    C1
$2.0 / 2.00 / 1.997 \times 10^8$ m / s    A1

**(b)** (infra-red / light) encoded **OR** (sent as) pulses **OR** multiplexing **OR** many messages
**OR** signal **OR** information **OR** data **OR** internet    B1
(optical fibre transmits) light / infra-red (pulse)    B1
total internal reflection / TIR (prevents escape)    B1

[Total: 7]

**6 (a)** mark **(i)** and **(ii)** together:
mention of free electrons    B1
(current is) flow/movement of free electrons    B1
insulators contain no free electrons / metals contain many free electrons    B1

**(b) (i)** chemical (energy) to electrical (energy)　　　　　(**IGNORE** heat)　　B1

　**(ii)** (energy =) $VIt$ **OR** $120 \times 96 \times 10$ (**OR** $\times 60$ **OR** $\times 10 \times 60$)
　　　**OR** $11\,520 \times 10$ (**OR** $\times 60$ **OR** $\times 10 \times 60$)　　C1
　　　$6.9 \times 10^6$ J　　A1

　**(iii)** $96 \times 120$ **OR** $1.2 / 1.15(2) \times 10^4$ **OR** $12\,000 / 11\,500 / 11\,520$　　C1
　　　$1.0 \times 10^4$ W　　A1

　　　　　　　　　　　　　　　　　　　　　　　　　　　　**[Total: 8]**


**7 (a)** 1500 m / s underlined / indicated　　B1


　**(b)** compression: closer together **AND** rarefaction: further apart　　B1

　　compression: particles / molecules / wavefronts closer together / low pressure
　　**AND** rarefaction: particles / molecules / wavefronts further apart / high pressure　　B1


　**(c) (i)** ($t =$) $d / v$ used **OR** $t = 2d / v$ **OR** $12 / 1500$ **OR** $0.008$ (s)　　C1
　　　(t =) $2d / v$ used **OR** $24 / 1500$　　C1
　　　$0.016$ s　　A1

　**(ii)** amplitude: decrease　　B1
　　　pitch: no change　　B1

　　　　　　　　　　　　　　　　　　　　　　　　　　　　**[Total: 8]**


**8 (a)** 6.0 V　　B1


　**(b) (i)** coulomb (**IGNORE** C)　　B1

　**(ii)** ($Q =$) $I\,t$
　　　**OR** $0.25 \times 12 \times 60$ **OR** $0.25 \times 720$ **OR** $0.25 \times 12$ **OR** $3.0$ **OR** $0.25 \times 60$ **OR** 15　　C1
　　　180 (C)　　A1

　**(iii)** ($R =$) $V / I$ or $6.0 / 0.25$ or 24.0 e.c.f. from **(a)**
　　　**OR**
　　　($V =$) $IR$ **OR** $0.25 \times 16$ **OR** $4.0$ e.c.f. from **(a)**　　C1

　　　$8.0 \ \Omega$　　A1


　**(c)** $R \propto l$ **OR** $8.0$ **OR** $16 / 2$　　C1
　　$R_1 R_2 / (R_1 + R_2)$ **OR** $1 / R = 1 / R_1 + 1 / R_2$ **OR** $64 / 16$ **OR** $1 / R = 1 / 8 + 1 / 8$　　C1
　　$4.0 \ \Omega$　　A1

　　　　　　　　　　　　　　　　　　　　　　　　　　　　**[Total: 9]**

**9** **(a)** **(i)** (magnetic field) lines closer together / denser / more lines          B1

        **(ii)** (magnetic field (lines) direction reversed          B1

    **(b)** **(i)** ammeter needle deflects / reading on ammeter          B1
           (magnetic) field cuts coil **OR** changing (magnetic) field          B1
           (electromagnetic) <u>induction</u>          B1

        **(ii)** deflection / reading on ammeter smaller **OR** lasts longer          B1
            slower rate of cutting field lines **OR** slower rate of change of field          B1

                                                                                     **[Total: 7]**

**10** **(a)** any one specific source of background radiation
      e.g. rocks, ground, building materials, radon, radiation from space, Sun,
      cosmic rays, nuclear waste          B1

    **(b)** **(i)** electromagnetic radiation **OR** photons          B1
           (very) high frequency **OR** (very) short wavelength **or** high energy          B1

        **(ii)** (count rate) decreases          B1

            (count rate decreases but) not completely absorbed (by lead)
            **OR** only some γ-rays detected          B1

    **(c)** **(i)** no deflection (last / fifth box ticked)          B1

        **(ii)** (γ-rays) are uncharged / neutral (**IGNORE** not affected by magnetic fields)          B1

                                                                                     **[Total: 7]**