# MARK SCHEME for the May/June 2014 series

# 9792 PHYSICS

**9792/02**    Paper 2 (Part A Written), maximum raw mark 100

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.

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**Section A – 75 marks**

1  (a)  $0 = 5.6^2 - 2 \times 9.81 \times s$ **or** $s = 1.60$ (m)  [1]
        5.6 (m)  [1]  [2]


   (b)  $2 \times 9.8 \times (5.6 - 0.8)$ **or** $\sqrt{2 \times 9.81 \times 4.8}$  [1]
        9.7 (m s$^{-1}$)  [1]  [2]


   (c)  $9.7 = -5.6 + (9.81 \times t)$ **or** $t = 15.3 / 9.81$  [1]
        1.56 (s)  [1]  [2]

                                                                        **[6]**


2  (a)  gravitational field strength is force per unit mass **or** with symbols defined  [1]  [1]


   (b)  g is not a force but an acceleration / gravitational field strength  [1]  [1]


   (c)  resultant force causing acceleration = thrust – weight  [1]
        $(76 \times 47) + (76 \times 9.81)$ **or** 4320 (N)  [1]
        45 400 (Pa)  [1]  [3]

                                                                        **[5]**


3  (a)  (i)  (energy stored =) ½ Fx  [1]
             ½ × 9000 × 4 = 18 000 (J)  [1]

       (ii)  total loss of GPE = mgh  [1]
             68 × 9.81 × 19.39 = 12 900 (J)  [1]

       (iii) stored in rope as elastic potential energy  [1]
             extension is 3.39 m **and** energy stored = ½kx$^2$  [1]
             ½ × (9000 / 4) × 3.39$^2$ = 12 9000 (J)  [1]  [7]

**(b)** **any two from:**
length does not affect (or reach) breaking strain / stress
final length / extension $\propto$ original length
GPE lost $\propto$ original length
elastic energy $\propto$ original length
final stress / strain is independent of original length
$k \propto 1$ / original length [2]
does not affect safety margin **and** two points from above [1]  [3]


**OR**
constant cross-sectional area of rope (1)
stress = force / area **and** stress not affected by length (1)
does not affect safety margin **and** area unchanged (1)

**[10]**


**4  (a) (i)** 3.2 **and** mm [1]

   **(ii)** 3.50 – 3.55 **and** ms [1]

   **(iii)** 282 – 286 **and** Hz [1]

   **(iv)** 2.5 – 2.8 squares **or** 0.5 – 0.56 (ms) [1]
      2.5/17.5 – 2.8/17.5 **or** 0.143 – 0.160 (of a cycle) [1]
      0.898 – 1.00 **and** rad [1]  [6]


**(b)** wavelength [1]  [1]


**(c) (i)** curve crosses axis at half-way points (by eye) [1]
      peaks and troughs at half-way points (by eye) **and** above $\pm 4$ mm [1]

   **(ii)** 5.6 – 5.7 mm [1]  [3]

**[10]**


**5  (a) (i)**

|   | red /° | green /° |
|---|--------|----------|
| 0 | 0      | 0        |
| 1 | 23.6   | 19.0     |
| 2 | 53     | 40.5     |
| 3 | –      | 77.2     |

     5 values correct 4 marks
     4 values correct 3 marks
     3 values correct 2 marks
     2 values correct 1 marks [4]  [4]

    **(ii)** one side correct (GRGRG)             [1]
        same on both sides             [1]   [6]

**(b)** fuzzy pattern instead of sharp         [1]

  **any two from:**
  red bands wider than green bands
  red bands wider apart than green bands
  (some yellow bands where) they overlap
  equally spaced maxima / minima / fringes
  missing orders         [2]   [3]

           **[9]**

**6 (a)** $230 \times 12.5$ **or** $2875\,(\text{W})$        [1]
    $m \times c \times \Delta\theta$ **or** $1.50 \times 4190 \times 83$ **or** $522\,000\,(\text{J})$   [1]
    $181\,(\text{s})$         [1]   [3]

**(b)** $1.5 \times 2.26 \times 10^{6}$        [1]
    $1180\,(\text{s})$         [1]   [2]

**(c) any two from:**
  heat losses from the kettle
  kettle needing to be heated up as well as the water
  some evaporation while water is heating up     [2]   [2]

           **[7]**

**7 (a)** $R = \rho l / A$        [1]
    $\pi \times (0.914 \times 10^{-3})^{2} / 4 = 6.56 \times 10^{-7}$   [1]
    $13.0\,(\Omega)$        [1]   [3]

**(b)** $7.2\,(\Omega)$        [1]   [1]

**(c)** $12 / (7.2 + 13)$ **or** $12 / 20.2$ **or** $0.594\,(\text{A})$ **or** $7.13\,(\text{W})$   [1]
    $2.5\,(\text{W})$        [1]   [2]

**(d)** current (in the cables) is (much) smaller     [1]
    proportion of the power wasted is (much) smaller / of resistance (much) less   [1]

  **OR**
  (total resistance =) $13 + 500\,(\Omega)$ **or** (current = )$0.195\,(\text{A})$
  p.d. across wire is $2.5\,(\text{V})$ **or** $0.195\,(\text{A}) < 0.594\,(\text{A})$ **or** $2.5\,(\text{V}) < 7.7\,(\text{V})$
  **or** $13 / 500 < 13 / 20.2$ **or** $0.492\,(\text{W}) < 4.58\,(\text{W})$   [2]
  MAX 2        **[8]**

**8** **(a)** **(i)** not dependent on anything like pressure, temperature, chemical activity, etc. [1]

**(ii)** cannot predict when a decay will occur [1] [2]

**(b)** **(i)** $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{236}_{92}U \rightarrow ^{143}_{54}Xe + ^{90}_{38}Sr + 3\,^{1}_{0}n$

intermediate nucleus inserted [1]
uranium as intermediate nucleus [1]
Xe nucleus correct [1]

**(ii)** more neutrons are produced than are used (to start a reaction) [1]
one neutron can continue chain **or** used in subsequent reaction
**or** all but one absorbed (on average) [1]

**(iii)** neutron absorbing material **or** control rods **or** boron [1]
vary the amount of absorber in the vicinity [1] [7]

[9]

**9** **(a)** **(i)** $hc/\lambda$ **or** $6.63 \times 10^{-34} \times 3.00 \times 10^{8}/470 \times 10^{-9}$ [1]
$4.23 \times 10^{-19}$ (J) [1]

**(ii)** $2.17 \times 10^{-19}$ (J) [1] [3]

**(b)** **(i)** $4.0 \times 15^{6}$ [1]
$4.6 \times 10^{7}$ [1]

**(ii)** $7.3 \times 10^{-12}$ (A) [1]

**(iii)** **any two from:**
they are accelerated
by an increasing p.d. between (electrodes)
more of them [2] [5]

**(c)** **any three from:**
the incoming light (may be) of many different colours
any photon with sufficient energy may release an electron
output electrons do not depend on incoming colour
wavelength information not transmitted
in the tube there is current not a wave
phosphor plate only produces white light
light emitted determined by energy bands/levels in phosphor [3] [3]

[11]

**Section B – 25 marks**

**10 (a) (i)** $7.98(t - 170) = 4.75t$ **or** $7.98t = 4.75(t + 170)$ **or** $420\,(\text{s})$ **or** $250\,(\text{s})$  [1]
7.0 min (accept 7 min)  [1]

    **(ii)** $1.995 \times 10^3\,(\text{km})$  [1]  [3]

**(b) (i)** vibration / oscillation parallel to energy transmission / wave **and**
vibration / oscillation perpendicular to energy transmission / wave  [1]
energy transferred (in at least one case)  [1]

    **(ii)** (region centred on point) opposite to epicentre / earthquake  [1]
(to reach this region) S-waves have to pass though the (outer) core / liquid
**or** S-waves cannot travel through liquids
**or** S-waves absorbed by (outer) core / liquid  [1]
**outer** core is liquid  [1]  [5]

**(c) (i)** speed increases  [1]

      **and any two from:**
temperature increases; density increases; pressure increases;
elasticity changes; molecular structure changes  [2]

    **(ii)** path curves **or** refracted  [1]
away from centre of earth **or** towards surface (**allow** concave)  [1]  [5]

**(d) (i)** correct arrow between 45° and 30° to the vertical  [1]

    **(ii)** $\sin 90° / \sin \theta = 13.7 / 8.25$ **or** $= 1.66$  [1]
$(\theta = )37.0\,(°)$ **or** 143**°**  [1]

    **(iii)** waves that just enter the outer core and those that just scrape across its
surface (are separated by the refraction in **(ii)**)  [1]
leads to a gap between these two positions **or** shown on diagram **and** no
S-waves on diagram (on surface)  [1]  [5]

**(e)**    **social:**

| | |
|---|---|
| locate earthquakes | [1] |
| locate landslides | [1] |
| warn about tsunamis / volcanoes | [1] |
| rush assistance quickly | [1] |
| identify archaeological sites | [1] |
| save lives / evacuate area | [1] |
| academic curiosity | [1] |
| identify erosion | |

**technological:**

| | |
|---|---|
| design buildings that resist earthquakes | [1] |
| locate gas / oil reserves | [1] |
| locate mineral reserves | [1] |
| locate water | [1] |
| locate sunken treasure / aeroplane Black boxes / oil tanks<br>(**not** seismic vibrations used) | [1] |
| predict / understand earthquakes / tsunamis / volcanoes | [1] |

**economic:**

| | |
|---|---|
| cheaper resources | [1] |
| no need to replace destroyed buildings | [1] |
| discover contamination | [1] |

**maximum for question = 7**         [7]

[25]