MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

5054 PHYSICS

5054/42   Paper 4 (Alternative to Practical), maximum raw mark 30

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.

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1 **(a)** to obtain uniform temperature/heat spread (uniformly) throughout oil   B1   [1]

    (b) temperature increase is slow/temperature change small/heats up slowly/
        oil doesn't become **too** hot/prevent overheating
        oil has low specific heat capacity/heats up quickly/oil has high boiling point/
        higher boiling point than water/above 110 °C/may break thermometer   B1   [1]

    (c)   **(i)** axes: correct way round, labelled quantity and unit   B1
            scales: more than ½ page, sensible 2 cm ≡ 2 s and 2 cm ≡ 10 °C   B1

             points plotted accurately to within ½ small square; dots ⩽ ½ small square   B1
             reasonable attempt at smooth curve of best fit neatly drawn   B1   [4]

       (ii) if line on graph not extrapolated to 80 °C   13.3 s ± 0.2 s   unit required
            if reasonable extrapolation, correct value read from graph   unit required   B1   [1]

      (iii) 110 °C/100 °C   unit required   B1   [1]

    (d) **temperature** of oil will have changed/decreased   B1   [1]

    (e)

        using two people to take the measurements   ✓   B1

        pouring the oil quickly after taking its temperature   ✓   B1   [2]

                                                   [Total: 11]

2 **(a)** time several/N oscillations (allow $5 \leqslant N \leqslant 40$ if value given) **and** divide by N B1
        repeat reading **and** average   B1

        any one from
        view perpendicular to swing
        time from centre/use fiducial marker/view at bottom of ruler/where speed max
        smooth swings/same amplitude   B1   [3]

    (b) **(i)** initially T decreases (as d increases)   B1
            (then) T increases (as d increases)   B1   [2]
            minimum T at $d = 20$ cm scores 2   allow just T increases for one mark

      (ii) 1.58 to 1.70 (s)   unit NOT required   B1   [1]

      (iii) at centre of mass of ruler/no moment/in equilibrium/balanced/does not move
            ruler will not oscillate/swing
            ruler spins/rotates
            T too large/very large   B1   [1]

                                                   [Total: 7]

3 (a) (i) slow reactions stopping stopwatch/started stopwatch early
faulty stopwatch/string wound incorrectly   B1   [1]

   (ii) 4.488   C1
4.49   accept 4.5   c.a.o.   3 / 2 s.f. only   A1   [2]

(b) 15 / 14.8 / 14.9 / %   unit required   no s.f. penalty   e.c.f. **(a) (ii)**   B1   [1]

(c) use a marker at 1 m/metre rule vertical/avoid parallax error/rule close to string/
parallax error described accurately   B1   [1]

                                                                               [Total: 5]

4 (a) so can be replaced (exactly) if moved/knocked/so rays can be drawn through
the block/to know where the ray changes direction/marks air-glass boundary   B1   [1]

(b) views P_1 and P_2 through block   M0
puts P_3 and P_4 **in line with** P_1 and P_2 B1   [1]

(c) (i) ray drawn accurately within block with ruler   B1   [1]

   (ii) normal drawn correctly
direction from centre of block   B1   [1]

   (iii) 34° ± 3°   B1   [1]

(d) i = 0/arrives along normal/90° to surface/passes through centre of block   B1   [1]

(e) ray 3 completed to match ray 1 inside block   e.c.f. **(c)**   B1   [1]

                                                                                [Total: 7]