MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

5054 PHYSICS

5054/04   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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

General Points

Lists:
Correct responses gain a mark; incorrect (NOT) responses lose a mark.
Lowest mark zero.
NB: Some comments can be ignored. These will be indicated in the marking scheme.

Observer:
When asked to draw in the position of an observer in an experiment:
- the eye should be on an approximately horizontal line with the reading
- may be •, E, x, ⊂•⊃ or optics eye looking towards reading

Parallax error:
A common answer to practical errors is parallax error. Read the instructions carefully for each answer as the detail required in each response will vary.
- just stating 'parallax error' maybe acceptable in some instances; check mark scheme
- stating the measuring instrument may be required, e.g. in reading the thermometer
- correct explanations of parallax error are acceptable alternatives,
- e.g. the line of sight must be perpendicular to the scale
- incorrect explanations of parallax error are marked incorrect,
- e.g. the eye is perpendicular to the reading/meniscus

Error Carry Forward (e.c.f.):
This applies in all calculations so one mistake is not penalised in later parts of the question.
It is indicated by e.c.f. in mark scheme.
There is usually no e.c.f. within a single calculation.

Significant Figures (s.f.):
In calculations, candidates are penalised for incorrect s.f. when asked to give answers to a suitable number of s.f. When measuring or reading from a diagram candidates must give answers to a suitable number of s.f. A common error here is to give too few s.f. e.g. when a measurement is 13.0 cm and the candidate quotes 13 cm.

Graphs:
Axes: labelled both quantity and unit
           labels and quantities to be on correct axes

Scales: must fill at least ½ grid in both directions i.e. cannot be doubled
           must be 'sensible', i.e. not multiples of 3, 7 etc.
           should follow instructions, e.g. start from the origin
           should have at least three values marked

Points: allow x, • or ⊙ (dot maximum size 1 mm diameter i.e. ½ small square)
           must be accurately plotted to ± ½ small square
           not awarded if scale not sensible

Line: attempt at single smooth line:
           curves need not be perfect!
           straight lines   - must be drawn with a ruler
                                      - must be best fit i.e. equal number of points above and below line
                                      - must not be skewed, i.e. not points at start/end all above/below the line

Awarding Marks

All marking points are called B, M, C or A marks.

- **B** marks are independent of other marking points.
- **A** marks are answer marks. If awarded all preceding C marks are automatically given.
- **C** marks are compensation marks. If the final answer (A mark) is not awarded the preceding C marks may be awarded for correct working seen.
- **M** marks must be awarded for any subsequent A marks to be awarded.

e.c.f.   error carry forward

c.a.o.   correct answer only

1 (a) values for P correct   31   62   91   123   151   186   B1
      values for S correct   6   12   17   24   28   34   B1   [2]

(b) axes: correct way round, labelled quantity and unit   B1
      scales: more than ½ page, linear, sensible, minimum 2 values marked, e.c.f. **(a)**   B1
      points: for P plotted accurately, neat (for linear, sensible scale), e.c.f. **(a)**   B1
      best fit straight line: for P from origin, neat   B1   [4]
      points: for S plotted accurately, neat (for linear, sensible scale), e.c.f. **(a)**   B1
      best fit straight line: for S drawn, neatly   B1   [2]

(c) as t increases, m increases / positive gradient / linear /
      mass increases by equal amounts in equal time in words or values quoted   C1
      directly proportional / $t \propto m$ / doubling t doubles m A2   [2]

(d) (i) calculations correct   369.36   212.44   117.48   84.64 (minimum 2 s.f.)   B1
           answer given to nearest cm^2 B1   [2]

      (ii) corners of container curved / l or w not uniform / outside of tray measured /
           due to thickness of walls   B1   [1]

      (iii) P (larger A) has steeper line than S (smaller A) / loss in mass P greater than
           S   B1   [1]

(e) (i) varies with time of day / weather/climate may change / temperature outside
           changes / sunny / raining / people in the room / room heater/air conditioning
           switched on/off   B1   [1]

      (ii) no effect   M0
           same for all containers / links answer to conclusion   A1   [1]

                                                  [Total: 16]

2 (a) distance between string and paper / string not close to or touching paper / need
      to view string from (vertically) above / not accurate if viewed from the side   B1   [1]

(b) 136° ± 2°   B1   [1]

(c) 5.8 N c.a.o.   unit required   B1   [1]

(d) 8.6 → 8.7   seen anywhere   M0
      5.7 → 5.8 N   unit required   A1   [1]

                                                    [Total: 4]

3 (a) (i) ray drawn from incident ray through M_1 and M_2 to prism and correct path through prism   B1   [1]

(ii) turned through 180° / path inverted / reflects/sends ray **back** / **total** internal reflection / speed decreases   B1   [1]

(b) answers refer to prism   M0
places two pins on incident ray with no use of alternative light source
answer may be stated or shown on diagram e.c.f. **(a) (i)** light path within prism   B1
places two more pins in line with pins/image/reflection (seen through prism)   B1   [2]

[Total: 4]

4 (a) line drawn on ammeter, from dot to scale reading 4.7 A ± ½ division   B1
line drawn on voltmeter, from dot to scale reading 11.6 V ± ½ division   B1   [2]

(b) allow 2 valid points in either 1 or 2   list rule applies
any two sensible answers, e.g.
- insulator around block
     allow named insulator NOT water
- block has shiny surface / painted white / wrapped in foil
- reduce draughts / use of box or container
- lid on box or container / air-tight container
- stand block on insulator
- heater completely into hole   B2   [2]

(c) allow all block to heat up / reach same/maximum/steady temperature /
allow heat to reach thermometer
allow experiment/temperature/it is more accurate   B1   [1]

(d) block may become too hot / burn someone / melt/damage heater / damage thermometer / heat loss increased   B1   [1]

[Total: 6]