UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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.

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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]