

## MARK SCHEME for the October/November 2007 question paper

### 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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

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- 1 (a) (allow) to reach terminal/constant velocity/stop accelerating/forces balance/  
speed/velocity not constant at start/near surface/speed zero at surface B1  
allow only constant velocity between bands  
not velocity decreases
- (b) reduces parallax error/see when sphere passes (behind) band/  
bands show when to start and stop stopwatch/distance measured accurately B1  
allow bands act as a reference point/mark(er)/fiducial mark(er)  
ball touches/hits band  
time/distance measured easily
- (c) yes/almost B1  
comments e.g. doubling/halving  $x$  doubles/halves  $t/x$  directly proportional to  $t$   
 $x = kt$  or  $x/t = k$  or  $t/x = k$   
or values quoted  
e.g. velocities calculated both 4.6 or 4.63 and 4.65 or approximately 5  
ratio found  $40/20 = 2$  and  $8.64/4.60 = 2.(0093)$   
**check table** doubling  $t$  gives 8.60, nearly same as 8.64  
halving  $t$  gives 4.32, nearly same as 4.30  
finding  $k$ :  $40/8.64 = 4.63$ ,  $20/4.30 = 4.65$   
or  $8.64/40 = 0.216$ ,  $4.30/20 = 0.215$  B1  
allow for one mark no + comment on table values  
no + ratios found and not the same  
no + difference is 0.04 s  
not just velocities are the same without evidence
- (d) (i) eye level horizontal and level with top band B1  
accept E/dot/👁 at side or on top of jar/eye drawn looking towards jar
- (ii) vertical ruler drawn on jar/no further than  $x$  marker arrow from jar B1  
accept rectangle with no labels or marks/line with marks or label
- (e) (i) all values to one d.p.(even if incorrect) B1  
any 2 answers in the range  $10.5 \rightarrow 10.6$ ;  $18.1 \rightarrow 18.2$ ;  $41.6 \rightarrow 41.7$  (3 or more sf) C1 }  
 $10.6$ ;  $18.2$ ;  $41.7$  all correct allow 3 or more sf ( $10.582$ ;  $18.182$ ;  $41.667$ ) A1 }  
allow inconsistent sf
- (ii) for one mark: doubling/halving  $d$  does not double/halve  $v$   
statement of requirement for directly proportional  
 $d$  not =  $kv$ ,  $d/v$  or  $v/d$  not constant C1 }  
graph of  $d$  against  $v$  not a straight line through 0,0
- for two marks: doubling  $d$  gives 4 x  $v$   
clear use of data from table to support statement A1 }  
allow sketch graph  
ecf table increasing  $d/v$  decreases  $v/d$   
not comparing  $d$  or  $v$  with  $t$ /inversely proportional/ $v \times d$  not constant  
explanation of linearity (e.g. rate of increase not same)

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
(iii) diameter of sphere; metal used for sphere; type of oil and none wrong  
any two correct and only one wrong scores one mark

✓
✓
✓

B2

[Total: 13]

2 (a) ammeter and d.c. power supply in series B1  
rheostat/variable resistor and d.c. power supply in series/  
variable power supply B1

ignore additional components if circuit works  
e.g. additional resistors/voltmeter correctly connected  
allow switch open or closed  
for power supply:   
for resistor: thermistor/LDR



not 

max 1 mark if any components drawn over circuit wire/additional incorrectly connected components

allow for one mark: correct ammeter and variable resistor with incorrect power supply  
no marks: no power supply shown

(b) (i) magnetic field small/increases field/more field lines/to attract the iron filings B1  
for the force to be reasonable/so the magnetic field can be detected  
not more fields/so iron filings are magnetised

(ii) help iron filings align with the field/reduce friction B1  
overcome inertia/filings large or heavy  
allow to show the field/so iron filings spread out/  
so iron filings can move

(iii) easier to move/easier to attract/show field more accurately/lighter weight/ B1  
less mass or inertia/more sensitive to the field/clearer field/  
follow field without overlapping  
allow show weaker field  
ignore more easily/quickly magnetised

[Total: 5]

3 (a) (i) incident ray continued straight with ruler (labelled XY) B1  
allow dotted line  
line to level with P<sub>4</sub>

(ii) (refracted and) emergent rays correctly drawn with ruler B1

(iii) (d) marked correctly between lines B1  
allow line not accurate but intention clear  
not horizontal line  
if d varies significantly

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(iv)  $d = 0.7$  to  $1.2$  cm to nearest mm unit required  
 ecf (a) (iii) for correct attempt at  $d$  B1  
 allow  $0.05$  cm  
 not to  $0.01$  cm e.g.  $0.90$  cm,  $0.92$  cm

(b)  $5.0$  cm/ $50$  mm (correct answer only) unit required unless penalised in (a) (iv) B1  
 allow  $5$  cm no s.f. penalty

(c) with  $t = 5$  cm

$d$	$n$
0.7	1.39
0.8	1.47
0.85	1.52
0.9	1.56
0.95	1.61
1.0	1.67
1.1	1.79
1.2	1.92

calculation correct to 2 d.p. ignore subsequent rounding B1

allow ecf (a) (iii) and (b)  
 not negative answer  
 unit given (e.g. °)

**[Total: 6]**

4 (a) (when  $d = 0$ ) band is not stretched/no force on block/block not pulled/moved yet/  
 band has no energy B1

(b) table for graph

5	13.3
6	20.9
7	28.7
8	39.6
9	51.8
10	62.5

axes: – correct way round, labelled quantity and unit  $\uparrow D/\text{cm} \rightarrow d/\text{cm}$  B1

scales: – sensible, more than  $\frac{1}{2}$  grid/from (0,0) B1

points: plotted accurately (within  $\frac{1}{2}$  small square) and neat B1  
 not if scale not sensible

line: best fit smooth curve, neat B1

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- (c) any sensible practical statement B1  
 e.g. (tape) ruler on bench/block slides along ruler/repeat experiment/  
 avoid parallax when reading (ruler)/used a thread/tape measure/string/  
 mark block position on floor/calibrate bench/  
 allow annotation on diagram page 8
- not use a stopwatch/time block

**[Total: 6]**

#### Marking Scheme Code

- B1 Independent mark
- C1 Compensation mark:  
 – is always followed by an A mark  
 – is given automatically if the answer is correct  
 – is given if the answer is wrong but the point is seen in the working
- A1 Answer mark
- ecf error carried forward; correct working using an error in previous working is credited