

## **MARK SCHEME for the May/June 2014 series**

### **5054 PHYSICS**

**5054/22**

Paper 2 (Theory), maximum raw mark 75

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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- 1 (a) (i) *D* and either lorry accelerates (forward) or resultant force is forward [B1]  
(ii) air resistance or (air) drag or friction (between tyres and road) [B1]
- (b) (i) 30 000 kg [B1]  
(ii) (a=)  $F/m$  algebraic in any form or numerical [C1]  
0.5(0)  $m/s^2$  [A1]
- (c) direction or velocity is changing or acceleration or force is sideways or towards centre (of circle) [B1]  
**[6]**
- 2 (a) (i) (P=)  $F/A$  algebraic in any form or numerical [C1]  
33  $N/cm^2$  or  $3.3 \times 10^5 N/m^2$  [A1]  
(ii) 170 N or 167 N or 166.7 N or (i)  $\times 5$  with unit [B1]
- (b) volume (of oil) remains the same  
or oil passes from small(er) to large(r) area  
or work =  $Fd$  and force large so distance small [B1]
- (c) output  $\div$  input or fraction or percentage of work mentioned [C1]  
complete definition, e.g. useful work obtained  $\div$  (total) work put in [A1]  
**[6]**
- 3 (a) (i) any sensible example where expansion is useful [B1]  
(ii) any sensible example where expansion causes a problem [B1]
- (b) (molecules) move fast(er) or vibrate fast(er) or have more (kinetic/potential/internal) energy [B1]  
(molecules) move apart or distance between molecules increases or vibration has larger amplitude or vibration takes up more space or bonds stretch [B1]
- (c) slightly smaller [B1]  
much larger [B1]  
**[6]**

Page 3	Mark Scheme	Syllabus	Paper
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- 4 (a) (i) up and down clear, e.g. by double headed arrow **or** down [B1]  
(ii) any correct distance between consecutive points in phase [B1]  
(iii) correct distance [B1]
- (b) measure number of oscillations / count waves (passing) in a stated time or time at least one oscillation [B1]  
show how to calculate number of oscillations per second [B1]
- (c) **moves** (hand or rope) with slow(er) speed or rate / less frequency / less times per sec [B1]  
**[6]**
- 5 (a) ultra violet **and** infra-red [B1]
- (b) blue refracts / bends / deviates more [B1]  
blue slows more (than red when entering glass) or blue and red have different speeds (from each other in glass) [B1]  
blue and red have different refractive indices [B1]  
**[4]**
- 6 (a) (i) any single value between 0 and 5.6 cm or a range all of whose values are correct [B1]  
(ii) any value beyond 5.6 cm [B1]
- (b) (i) ray through optical centre undeviated [B1]  
other ray correct through or to axis 2.8 cm ( $\pm \frac{1}{2}$  small square) from lens [B1]  
(ii) lines drawn meet after 11 cm or rays do not meet (on page) or rays almost parallel [B1]  
(iii) inverted, magnified, real all 3 needed and none wrong [B1]  
**[6]**
- 7 (a) (i) **horizontal** arrow to right (by eye) [B1]  
(ii) forces / resultant causes moment or (turns because) force is not at pivot [B1]
- (b) mark made at one end / pole / direction of compass (on paper) [B1]  
move compass so that other end of compass is on mark **and** remark [B1]  
join marks made as compass moved on in some way (to draw line) [B1]  
**[5]**

Page 4	Mark Scheme	Syllabus	Paper
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- 8 (a) (i) electron(s) and proton(s) [B1]  
(ii) neutron(s) and proton(s) [B1]
- (b) (i) top box 14 [B1]  
bottom box 7 [B1]
- (c) (i) sensible halving seen, e.g.  $2.4 \rightarrow 1.2$  or two halves clear or  $\frac{1}{2} \times \frac{1}{2}$  seen [C1]  
11 400 or 11 000 years [A1]
- [6]**
- 9 (a) straight line from (0, 0) to (3, 2.4) [B1]  
horizontal line from 3 s to 8 s [B1]  
straight line from **end of a horizontal line** to zero in 1 s [B1]
- (b) constant/same increase in velocity or **constant** change in velocity [C1]  
constant/same increase in velocity per sec/unit time [A1]
- (c) occurs in a short(er) time  
or acceleration took 3 s and deceleration took 1 s [B1]
- (d) (d =) speed  $\times$  time numerical or algebraic or area under graph clear [C1]  
 $1.2 \times 3$  or 3.6 (m) or  $2.4 \times 5$  or 12 seen [C1]  
15.6 m or 16 m [A1]
- (e) (i) mgh seen in any algebraic or numerical form, e.g.  $30 \times 10 \times 1.6$  [C1]  
480 J [A1]
- (ii) heat or thermal energy or sound produced  
or **work done** against friction/air resistance [B1]
- (f) at least two distances and corresponding times mentioned [C1]
- how the **actual measurement** is made, e.g. (**any one from**)
- make mark on ground every second and **measure** distances
  - note video position every sec and use a scale to **find** distances
  - make mark on ground every meter and **measure/take** time as girl passes [A1]
- how constant speed is proved using measurement, e.g. (**any one from**)
- same distance between each position for the same time interval
  - same time interval for equal distances
  - $\Delta d/\Delta t$  constant or slope of distance-time graph constant [B1]
- [15]**

Page 5	Mark Scheme	Syllabus	Paper
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- 10 (a) (i) (conduction occurs) through or in metal/pan **or** from water to metal/pan  
**or** molecules vibrate **or** molecules collide  
**or** (free) electrons (in metal) move [B1]
- vibration/energy/heat passed **from molecule to molecule** clear  
**or** energy passed on by electrons colliding (with atoms/molecules or electrons) [B1]
- (ii) hot air or air over water rises or hot water rises [B1]  
hot air or hot water expands **or** hot air or water less dense [B1]
- (b) (i) black objects radiate heat more (than white) [B1]
- (ii) (both) graphs higher (after start)  
**or** temperature falls less (in same time)/slower  
**or** takes longer to cool [B1]
- less **evaporation** occurs **or** less **convection** [B1]
- (c) (i) heat/energy to change the temperature by 1°C/unit temp [C1]  
heat/energy to change the temperature of 1 kg/unit mass by 1°C/unit temp [A1]
- (ii) long time to warm/boil water/cook  
**or** scalds/burns when touched  
**or** more energy needed (to warm water) [B1]
- (iii) 1. 34(°C) **or** 94–60 seen [C1]  
(m=)  $Q/c\Delta T$  algebraic or numerical with any clear Q or  $\Delta T$  [C1]  
0.5(042) kg [A1]  
2.  $0.50 \times 4200 \times 54$  [C1]  
110 000 **or** 114(353) J [A1]
- [15]
- 11 (a) ammeter and voltmeter correct symbols [B1]  
ammeter in series with lamp [B1]  
voltmeter in parallel with lamp [B1]
- (b) R limits or reduces the current/voltage [B1]  
otherwise lamp blows  
**or** more of the 50Ω can be used to adjust voltage/current [B1]
- (c) (i) 12V, 0.25A correctly plotted (by eye) [B1]  
curved line from origin [B1]  
correct curvature – decreasing slope [B1]
- (ii) straight line (for fixed resistor) [B1]  
**lamp** has changing temperature or changing resistance  
**or** fixed resistor has constant temperature or constant **resistance** [B1]

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- (d) (i) ( $I = V/R$  in any algebraic or numerical form, e.g.  $12/50$ ) [C1]  
0.24 A [A1]
- (ii) 0.49 A [B1]
- (iii) 6(.0)V [B1]
- (iv) 12(.24) $\Omega$  [B1]
- [15]