CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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

(ii) air resistance **or** (air) drag **or** friction (between tyres and road)

(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** 3.3×10^5 N / m^2 [A1]

(ii) 170 N **or** 167 N **or** 166.7 **N or (i)** × 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 ÷ input **or** fraction or percentage of work mentioned [C1]
complete definition, e.g. **useful** work obtained ÷ (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]

4 **(a)** **(i)** up and down clear, e.g. by double headed arrow **or** down

(ii) any correct distance between consecutive points in phase

(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 (± ½ 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]

8 **(a)** **(i)** electron(s) and proton(s)

(ii) neutron(s) and proton(s)

(b) **(i)** top box 14 [B1]
bottom box 7 [B1]

(c) **(i)** sensible halving seen, e.g. 2.4 → 1.2 **or** two halves clear **or** ½ × ½ 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 × time numerical or algebraic **or** area under graph clear [C1]
1.2 × 3 **or** 3.6 (m) **or** 2.4 × 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 × 10 × 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]

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

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 / cΔT algebraic or numerical with any clear Q or ΔT [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 50 Ω can be used to adjust voltage / current [B1]

(c) **(i)** 12 V, 0.25 A 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]

(d) (i) (I =) V / R in any algebraic or numerical form, e.g. 12 / 50
0.24 A

(ii) 0.49 A [B

(iii) 6(.0) V [B1]

(iv) 12(.24) Ω [B1]

[15]