

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge Ordinary Level

## **MARK SCHEME for the October/November 2014 series**

### **5054 PHYSICS**

**5054/21**

Paper 2 (Theory), maximum raw mark 75

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### Section A

- 1 (a) (i)  $(a = ) (v-u)/t$  or  $\Delta v/t$  or  $(55-40)/2$  or equivalent values from graph  
7.5 m/s<sup>2</sup> C1  
A1
- (ii)  $(F = ) ma$  or  $180 \times 7.5$  C1  
1300/1350/1400 N A1
- (b) (i) (acceleration) decreases (to zero) B1
- (ii) air resistance/friction/drag mentioned B1  
air resistance/friction/drag increases (with speed) or resultant force  
decreases (with speed) B1  
(finally) (air) resistance = driving force or resultant is zero B1 [8]
- 2 (a) (i)  $F_1 \times d_1 = F_2 \times d_2$  or  $(0.39 \times 0.40)/0.30$  C1  
0.52 N A1
- (ii) 0.052 kg or 52 g B1
- (b)  $(\rho = ) m/V$  or  $52/60$  or  $0.052/0.000\ 060$  or  $0.052/60$  B1  
 $870/867/866.7\text{ kg/m}^3$  or  $0.87\text{ g/cm}^3$  or  $8.7 \times 10^{-4}\text{ kg/cm}^3$  etc. B1 [5]
- 3 (a) (atoms/molecules/particles) move (about)/collide/hit B1  
(atoms/molecules/particles) collide/hit the walls/surface (of the cylinder) M1  
force on walls (causes pressure) A1
- (b) atoms/molecules/particles closer/more compact/more molecules per unit  
volume/less space to move B1  
more collisions with the wall/surface (of chamber) not if speed/KE changes B1 [5]
- 4 (a) any two from:  
transmission of energy  
without net movement of medium  
through vibration of particles B2
- (b) (i) number of (complete) waves/cycles/oscillations per unit time/second B1
- (ii) distance between (neighbouring) waves C1  
distance between (neighbouring) wavefronts/points of same phase or crest  
to crest/tough to trough distance A1
- (c) three reflected wavefronts roughly correct direction M1  
wavelengths equal to each other and incident wavelength by eye A1  
reflected wavefronts joined to incident wavefronts B1 [8]

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5	(a) longitudinal / pressure / sound (wave) <b>or</b> compressions <b>and</b> rarefactions (frequency) greater than 15 – 25 kHz / above limits of audibility	B1 B1	
	(b) $(x = ) vt/2$ <b>or</b> $340 \times 0.030/2$ <b>or</b> $340 \times 0.015$ <b>or</b> 10.2 5.1 m	C1 A1	[4]
6	(a) <b>electrons</b> repelled by cloud (leaving ground positive) <b>not</b> positive charge / protons move like charges repel <b>or</b> electrons negative	B1 B1	
	(b) (region) where (electric) charge experiences a force	B1	
	(c) $(I = ) Q/t$ <b>or</b> $180/0.0015$ $1.2 \times 10^5 \text{ A}$	C1 A1	[5]
7	(a) wire cuts field lines current / e.m.f. / voltage <b>induced</b>	B1 B1	
	(b) larger deflection <b>and</b> to the left / opposite direction	B1	
	(c) no deflection / current	B1	[4]
8	(a) neutrons and protons together and alone in the middle 5 protons 7 neutrons (if protons and neutrons unlabelled 1/2) 5 electrons <b>and</b> electrons surrounding nucleus	B1 B1 B1 B1	
	(b) (i) 6	B1	
	(ii) 12	B1	[6]
			[Total: 45]

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### Section B

- 9 (a) any **two** from:  
 biomass / wood; geothermal power; solar power; tidal power; wave power; wind power  
 B2 [2]
- (b) (i) 1.  $2.1(4) \times 10^{17}$  J (**allow**  $2.1(5) \times 10^{17}$  J if candidate uses 365.24/5) B1  
 2. any **one** from: not enough water (to maintain maximum flow); rainfall varies (during the year); periods of low demand B1
- (ii) 1. (GPE = )  $mgh$  **or**  $1.6 \times 10^{10} \times 10 \times 170$  C1  
 $2.7(2) \times 10^{13}$  J A1  
 2.  $2.7(2) \times 10^{13} / 3600$  **or**  $6.8 \times 10^9 \times 3600$  **or**  $6.8 \times 10^9 / 7.5(55) \times 10^9$  **or**  
 $2.4(48) \times 10^{13} / 2.7(2) \times 10^{13}$  C1  
 0.90 **or** 90% A1  
 3. any **two** from:  
 friction (of water) with pipe / turbine /; viscosity of water; friction at bearings; resistance / heat in the wires; KE of water leaving turbine B2 [8]
- (c) (i) less energy lost / wasted **or** more efficient B1  
 (for a given power) a high voltage results in a small(er) current B1  
 less heat generated in wires **or**  $I^2R$  **or** less resistive losses  
 (**not** if changed resistance mentioned) B1
- (ii) transformer B1
- (iii) transformers only work with an a.c. supply B1 [5]
- [Total: 15]
- 10 (a) (i) **heated / hot water** expands **or** density of **heated / hot water** decreases B1  
 (heated / hot water) rises B1  
 convection (current) / circulation set up **or** (heated / hot water) rises **and** cold water sinks B1
- (ii) convection transfers heat upwards **or** less dense / heated / hot water (already) at top B1 [4]
- (b) (i) (Q = )  $VIt$  **or**  $230 \times 9.6 \times 3.5$  **or**  $230 \times 9.6 \times 3.5 \times 60$  **or** 7728 C1  
 $4.6(368) \times 10^5$  J A1
- (ii) ( $\Delta T =$  )  $Q / mc$  **or**  $4.6(3680) \times 10^5 / 1.6 \times 4200$  C1  
 69 (°C) C1  
 91 °C A1
- (iii) evaporation **or** thermal energy / heat in **plastic casing / element / surroundings** (i.e. air or environment) B1 [6]

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	(c) (i) poor conductor (heat or electricity) <b>or</b> less heat lost/cooler to touch <b>or</b> less risk of shock	B1	
	(ii) poor emitter <b>and</b> less heat lost/of radiation/IR ( <b>not</b> poor absorber)	B1	[2]
	(d) (i) <b>temperature</b> where liquid and vapour/gas coexist <b>or</b> where liquid ( <b>not</b> substance) boils (at atmospheric pressure)( <b>allow</b> becomes vapour/gas)	B1	
	(ii) (work done) against/overcoming forces between molecules <b>or</b> molecules gain P.E. ( <b>ignore</b> K.E. increases) changes to P.E./molecules separate	B1 B1	[3]
			[Total: 15]
11	(a) (i) energy to drive charge around a circuit <b>or</b> terminal p.d. on open circuit energy to drive <b>unit</b> charge around a circuit <b>or</b> energy/charge	B1 B1	
	(ii) lasts longer <b>or</b> lower internal resistance <b>or</b> can replace a cell without switching off <b>or</b> continues to work if one cell is flat <b>ignore</b> more current ( <b>not</b> greater e.m.f./voltage)	B1	[3]
	(b) (i) 4.0Ω	B1	
	(ii) $(1/R_{\text{tot}} = )1/R_1 + 1/R_2$ <b>or</b> $1/3 + 1/X$ <b>or</b> product/sum <b>or</b> $(3 \times X)/(3 + X)$ <b>or</b> $\frac{1}{X} = \frac{1}{2} - \frac{1}{3}$ 6.0Ω	C1 A1	[3]
	(c) (i) $(I = ) V/R$ <b>or</b> 2.0/4.0 0.50 A	C1 A1	
	(ii) (from) 0 <b>and</b> (to) 0.50 to 5.0 A	B1	[3]
	(d) $I_2 = I_3 + I_X$	B1	[1]
	(e) (i) 1.0V	B1	
	(ii) 1.0V	B1	[2]
	(f) (i) temperature decreases resistance decreases	B1 B1	
	(ii) greater than 0.75 A (e.c.f. resistance increases in (f)(i))	B1	[3]
			[Total: 15]