

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Ordinary Level**

## **MARK SCHEME for the October/November 2012 series**

### **5054 PHYSICS**

**5054/21**

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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### Section A

- 1 (a) 950 N  
upwards B1  
B1
- (b) correct rectangle **and** diagonal **and** at least one velocity labelled  
**or** correct triangle and at least one velocity labelled  
(either way round) B1  
from 7.8(0000) to 8.0(0000) m/s (inclusive) B1  
scale stated B1 [5]
- 2 (a) (i) output/voltage/e.m.f. (directly) proportional to temperature (difference) B1
- (ii)  $\frac{7.70 - 6.20}{800 - 750}$  **or** 1.5/50 **or** 0.03 **or** 0.6/1.5 **or** 20(°C) C1  
770 °C A1
- (b) glass melts/liquid boils/no remote reading (e.g. head in furnace) B1 [4]
- 3 (a) (i)  $(WD = )mgh$  **or**  $54 \times 10 \times 2.8$  C1  
1500/1510/1512 J A1
- (ii)  $(P = ) WD/t$  **or**  $E/t$  **or** 1500/3 **or** 1510/3 **or** 1512/3 C1  
500/503/504 W A1
- (b) any **two** of:  
also lifting board/rope  
heat in motor/wires/cable  
friction with something named e.g. axle/spindle/air B2
- (c) (i) power supply, motor and ammeter in series  
(**ignore** series voltmeter and other components) B1  
voltmeter to measure voltage across motor B1
- (ii) current (reading)  $\times$  voltage (reading) **or**  $VI$  B1 [9]
- 4 (a)  $(m = )\rho V$  **or**  $740 \times 30$  **or** 22 000/22 200 C1  
25 000/2.5  $\times 10^4$  kg (allow 24 800 from 22 000) A1
- (b)  $(a = )F/m$  **or** 30 000/25 000 C1  
(-) $1.2 \text{ m/s}^2$  A1 [4]

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- 5 (a) (i) clear attempt at measuring more than one wavelength e.g. 6.85/5  
or 1.30 – 1.45 cm  
10.7 – 11.3 cm  
B1  
B1
- (ii)  $(v = )f\lambda$  or  $3.6 \times$  (a)(i)  
40(39.6) cm/s  
C1  
A1
- (b) (i) stays the same  
B1
- (ii) decreases  
B1 [6]
- 6 (a) any **three** of:  
infra-red and microwaves reversed  
visible light is omitted  
ultrasound is not e.m./should not be included  
ultraviolet is missing ('ultrasound instead of light' scores 2)  
B3
- (b) engineering use M1 detail/explanation A1
- detecting cracks in metal (more) X-rays pass through crack/poor weld  
**or**  
checking welds image of crack on film/screen  
astronomy hot stars emit X-rays  
crystallography diffraction reveals pattern of atoms  
fluorescence substances re-emit different energies  
(airport/border) security contents of luggage/lorries revealed  
paintings investigated underpainting revealed
- (**not** medical use) [5]
- 7 (a) (at least) **two** parallel horizontal lines within the cylinder B1  
(at least) **two** correctly shaped lines outside the cylinder B1
- (b) (i) ← (right to left) **and** on diagram (somewhere) B1
- (ii) 1. path continuously curving in same direction M1  
upwards (**ignore** lines outside the shaded area) A1  
2. (changes to) downwards (curve) **not** reverses/opposite direction B1 [6]

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- 8 (a) (i)  $(V = )IR$  or  $0.025 \times 600$   
15V C1  
A1
- (ii)  $5(V)$  or  $5/0.025$  or  $800$  or  $800-600$   
 $200 \Omega$  C1  
A1
- (b) (i) decreases B1
- (ii) ammeter: opposite to (i)  
voltmeter: same as ammeter (both changes correct) B1 [6]
- [Total: 45]

### Section B

- 9 (a) (i)  $(\Delta P = ) \rho gh$  or  $1000 \times 10 \times 120$   
 $1.2 \times 10^6 \text{ Pa}$  C1  
A1
- (ii)  $1.3 \times 10^6 \text{ Pa}$  B1 [3]
- (b) (i)  $(F = )PA$  or  $1.2 \times 10^6 \times 0.45$  or  $1.3 \times 10^6 \times 0.45$  or  $5.4 \times 10^5$  (N)  
 $5.8/5.85/5.9 \times 10^5 \text{ N}$  C1  
A1
- (ii) any **two** of:  
weight of hatch  
pressure inside submarine  
friction at seal/hinge/water resistance  
lever effect B2 [4]
- (c) (i) sound or pressure wave B1  
**frequency** > 20 kHz/**frequency** beyond human hearing/inaudible B1
- (ii) (water) molecules/particles vibrate/oscillate B1  
molecules collide with other molecules/neighbours B1  
pass on vibration/energy (to neighbours)  
or longitudinal (vibration/wave) or compressions and rarefactions B1
- (iii) 1. speed of sound/ultrasound (in water/sea water) B1  
2.  $\text{speed} \times t \div 2$  B1
- (iv) cleaning/quality control/detecting cracks/prenatal screening/  
kidney stones/detecting shoals of fish/(used by dolphins/bats) B1 [8]
- [Total: 15]

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- 10 (a)  $16 \times 7.5$  or  $120$  or  $96-17$  or  $79$   
 $(Q = )mc\Delta T$  or  $120 \times 2300 \times 79$   
 $2.2(2.1804) \times 10^7 \text{ J}$  C1  
C1 [3]  
A1
- (b) (i)  $2.2 \times 10^7/7$  or  $2.2 \times 10^7/(7 \times 60)$  or  $2.2 \times 10^7/(7 \times 3600)$  C1  
 $3.1 \times 10^6 \text{ J/h}$  or  $5.2 \times 10^4 \text{ J/min}$  or  $870 \text{ J/s}$  or  $\text{W}$  A1
- (ii) (heater/bricks) hot(ter) (**not** room cooler) B1  
great(er) temperature difference (between heater and room) B1 [4]
- (c) air (next to heater) gets hot or conduction through metal/casing B1  
expands or radiation or IR (radiation) B1  
less dense B1  
rises B1  
circulation or convection current or arrows on Fig. 10.2 B1 [5]
- (d) double glazing/cavity walls/ceiling tiles/carpet/curtains/loft insulation etc. or shiny foil B1  
traps air radiation reflected M1  
air is poor conductor/convection IR radiation/  
prevented back into room A1 [3]

[Total: 15]

- 11 (a) (i) correct negative charges on tree. B1
- (ii) electrons/-ve charges attracted by cloud/+ve charges B1  
electrons from ground or correct induction mentioned B1
- (iii) 1.  $560/1.6 \times 10^{-19}$  C1  
 $3.5 \times 10^{21}$  A1
2.  $(I = )Q/t$  or  $560/2 \times 10^{-4}$  C1  
 $2.8 \times 10^6 \text{ A}$  A1 [7]
- (b) (i) at least 4 vertical lines between plates B1  
equally spaced or curved at edges B1  
arrows +ve to -ve/upwards B1
- (ii) oil droplet positively charged B1  
attraction/force on (droplet) and in direction of field/upwards B1  
force greater than weight (of droplet) or resultant force B1
- (iii) (droplet becomes) negative C1  
(droplet) gains electrons A1 [8]

[Total: 15]