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GCE Ordinary Level

MARK SCHEME for the October/November 2012 series

5054 PHYSICS

5054/21 Paper 2 (Theory), maximum raw mark 75

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Section A

1	**(a)**	950 N		B1	
		upwards		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 × 10 × 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) × voltage (reading) or *VI*	B1	[9]
4	**(a)**	(*m*=)ρV **or** 740 × 30 or 22 000/22 200		C1	
		25 000/2.5 × 10^4 kg (allow 24 800 from 22 000)		A1	
	(b)	(*a* =)*F*/*m* **or** 30 000/25 000		C1	
		(–)1.2 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 B1
10.7 – 11.3 cm B1

(ii) (v =)$f\lambda$ **or** 3.6 × **(a)(i)** C1
40(39.6) cm / s 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		**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 × 600	C1	
			15 V	A1	
		(ii)	5(V) **or** 5/0.025 **or** 800 **or** 800–600	C1	
			200 Ω	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)	(ΔP=) ρgh **or** 1000 × 10 × 120	C1	
			1.2×10^6 Pa	A1	
		(ii)	1.3×10^6 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** 5.4×10^5 (N)	C1	
			5.8/5.85/5.9 × 10^5 N	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. speed × t ÷ 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 × 7.5 **or** 120 **or** 96–17 **or** 79 C1
(Q =)$mc\Delta T$ **or** 120 × 2300 × 79 C1
2.2(2.1804) × 10^7 J A1 [3]

(b) (i) 2.2 × 10^7/7 **or** 2.2 × 10^7/ (7 × 60) **or** 2.2 × 10^7/ (7 × 3600) C1
3.1 × 10^6 J / h or 5.2 × 10^4 J / min or 870 J / s or 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 × 10^{-19} C1
3.5 × 10^{21} A1

2. (I =)Q/t or 560/2 × 10^{-4} C1
2.8 × 10^6 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]

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