

CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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MARK SCHEME for the October/November 2013 series

5054 PHYSICS

5054/22

Paper 2 (Theory), maximum raw mark 75

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Section A

- 1 (a) (i) arrow(head) on chain pointing to the right B1
- (ii) vertical arrow downwards and part of arrow touching **or** within rectangle of lights **or** direction of arrow in (i) **and** (ii) correct (by eye) B1
- (b) scale given (must have unit of cm:N **or** cm/N **or** N:cm **or** N/cm) correct triangle **or** rectangle (might be implied) and correct resultant (compulsory e.c.f. from (i) **or** (ii): i.e. correct diagonal according to candidate's (i) and (ii)) B1
 $272 \leq \text{candidate's value} \leq 283 \text{ N}$ B1 [5]
- 2 (a) (m =) ρV **or** 1000×0.150 C1
150 kg A1
- (b) (when full) greater mass **or** greater momentum B1
- more inertia **or** mass resists change in state of motion
or small(er) deceleration (for same force)
or large(r) force for same deceleration (rate of decrease of momentum for deceleration) B1
or
greater kinetic energy (B1)
more work done in same distance (to stop) (B1) [4]
- 3 (a) (i) ($p =$) F/A **or** $12\,000/0.048$ **or** $12\,000/0.14$ C1
or (in (ii)) ($F =$) pA **or** $2.5 \times 10^5 \times 0.14$ A1
 $2.5 \times 10^5 \text{ Pa}$
- (ii) 35 000 N A1
- (b) atmospheric pressure **or** friction (between cylinder and piston/oil) B1
(accept bubbles (of air) in oil **or** viscosity of oil)
- (c) (W.D. =) $F \times d$ **or** $12\,000 \times 0.065$ **or** $35\,000 \times 0.065$ **or** 2275 C1
780 J A1
- (d) (liquids) incompressible **or** air spongy **or** (oil) lubricates the system **or** (oil) reduces friction B1
(ignore density references, ignore oil compresses less) [7]

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- 4 (a) 56 °C (not ° or C°) B1
- (b) (Q =) ml or 110 × 210 C1
2.3(1) × 10⁴ J A1
- (c) (i) (wax) is solidifying or freezing B1
- (ii) (molecules) form structure/come closer/lose PE or bonds made/stronger (no e.c.f. from (c)(i)) M1
KE. of molecules const. or replace/release/produce energy/heat (transferred to environment/latent heat emitted) (no e.c.f. from (c)(i)) A1 [6]
- 5 (a) transmission of energy through a medium or vibration or oscillation or two opposite motions (e.g. up and down) or compressions and rarefactions vibration direction parallel to energy travel/wave direction or similar C1
A1
- (b) (i) 1.5–2.5 × 10⁴ Hz or 15–25 kHz cao B1
15–25 Hz cao B1
- (ii) (λ =) c/f or 330/either of candidate's frequencies C1
330/candidate's higher frequency and correctly calculated with unit (candidate's higher frequency is either the one stated as the highest or the one that is in fact the higher) A1 [6]
- 6 (a) electrons (move) M1
to the fuel or from the pipe or pipe becomes positively charged (not moving protons/+ve charges) A1
- (b) spark (jumps from the plane) B1
ignite the fuel/explosion/blast B1
or
current from ground (B1)
shock (to worker/passenger) (B1)
- (c) (i) (metal an electrical) conductor or has low resistance or allows/lets charges/ electrons to flow through it B1
(this is general: about the conduction property of metals)
- (ii) charge/electrons flow along the cable or (plane/charges) earthed B1
(this is specific: about the conduction in this case) [6]

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- 7 (a) a power \times a time \times the unit price
(e.g. $1.2 \times 75/60 \times 4 \times 21$ **or** $1200 \times 75/60 \times 4 \times 21$ **or** $1.2 \times 75 \times 4 \times 21$
or $1.2 \times 75/60 \times 21$ **or** 5 (hr) **or** 6 (kW h)) C1
a power \times a time \times the unit price and with maximum of one physics
error (i.e. use of 1200 **or** omits 60 **or** omits 4)
(e.g. $1200 \times 75/60 \times 4 \times 21$ **or** $1.2 \times 75 \times 4 \times 21$ **or** $1.2 \times 75/60 \times 21$ **or**
126 000 **or** 7560 **or** 31.5 (accept 0.21 for 21 and 75.60 and 0.315)
(if this C mark is scored so is the previous one) C1
126/130 c **or** \$1.26/1.30 **or** €/£/Rs 1.26/1.30 etc. A1
- (b) (if) case becomes live **or** live wire touches the case B1
fuse blows **or** (large) current to earth **or** no current in workman
(**ignore** excess; **not** “some current”) B1 [5]
- 8 (a) (i) any two of:
minimise time of exposure
lead clothing (e.g. lead gloves **not** radioactive suit)
tongs, manipulator, forceps, tweezers
behind protective/lead glass/shield
wear film badge B2
- (ii) (radioactive emission) random/unpredictable (process)
(e.g. background radiation is random; **ignore** spontaneous) B1
- (b) penetration strong(er) **or** penetrates casing (accept α **or** β **or** both;
ignore larger range) B1
(more) weakly/slowly ionising B1
either explained: harms health **or** hazardous **or** dangerous
or air is not ionised **or** sounds all the time (accept doesn't work) B1 [6]
- [Total: 45]**

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Section B

- 9 (a) force \times distance **or** $F \times d$ with F and d defined **or** $F \times d_{\text{perp}}$
force \times perpendicular distance **or** $F \times d_{\text{perp}}$ with F and d_{perp} defined C1 A1 [2]
- (b) (i) 1. $6 \times 750 \times 1.2$ **or** 750×1.2 **or** 900 C1
5400 N m A1
2. mgh **or** $350 \times 10 \times 160$ **or** $350 \times 10 \times 1.6$ C1
 $350 \times 10 \times 1.6$ **or** 5.6×10^5 C1
5600 J A1
- (ii) friction at axle/boat **or** drag due to water B1
or chain lifted also B1
heat produced (**ignore** in sailors) **or** work done against friction/drag B1
or work done raising chain B1
- (iii) same amount of work done **or** $P = E/t$ **or** $P = WD/t$ B1
in less time **or** power inversely proportional to time (**ignore** faster rate) B1 [9]
- (c) clear/labelled diagram with ruler, fulcrum, at least two weights B1
any three of the following points made in words:
balance ruler (on its own)
place weights on ruler so it balances
clockwise and anticlockwise moments equal **or** net moment zero
repeat (apply similar principles to other possible methods) B3 [4]

[Total: 15]

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- 10 (a) (i) start at origin **and** not horizontal B1
 gradient (gradually) decreasing (**ignore** sudden decrease) B1
 (not if part of curve above horizontal section) B1
 final horizontal section (≥ 1 cm) (not if v is shown as $\neq 40$ m/s) B1
- (ii) area **under** the graph **or** count squares **under** graph M1
 between $t = 0$ and horizontal section **or** when speed is changing **or**
 calculate equivalent distance to 1 cm^2 (after counting squares) A1 [5]
- (b) (i) friction/air resistance increases (as speed increases) B1
 resultant force decreases
 (**not** if driving force decreases) B1
- (ii) (air resistance increases until) net force becomes zero **or** forces balance
or air resistance and driving/forward force are in equilibrium/balanced/equal B1 [3]
- (c) (i) $(KE =) \frac{1}{2}mv^2$ C1
 $\frac{1}{2} \times 5.5 \times 10^5 \times 40^2$ C1
 $4.4 \times 10^8 \text{ J}$ A1
- (ii) (total energy input =) useful energy output efficiency **or**
 efficiency = useful power output/total power input **or** $4.4 \times 10^8 / 0.40$ C1
 $1.1 \times 10^9 \text{ J}$ A1
- (iii) two valid examples
 e.g. furnace/boiler/turbines/generator/coils/cooling water/cooling towers/heat
 exchanger/transformer/chimney/waste gases/
 transmission cables/lines/wires (**ignore** power station/all parts of motor) B2 [7]

[Total: 15]

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11 (a)	work done per (unit) charge/coulomb/C or energy transformed per (unit) charge/coulomb/C	B1	
	property of a source (of electricity) or energy transformed to electrical energy per (unit) charge/coulomb/C	B1	[2]
(b) (i)	ammeter in series	B1	
	(ii) voltmeter in parallel with lamp or lamp and ammeter	B1	[2]
(c) (i)	(V =) 2.0 (V)	C1	
	(R =) V/I or 2.0/0.70	C1	
	2.9/2.86 Ω (i.e. 2 or 3 s.f. only)	A1	
	(ii) (resistance) increases	B1	[4]
(d)	(P =) VI or $P = V^2/R$ or $I^2 R$ or 12×2.0 or 12×0.70	C1	
	24 W	A1	[2]
(e) (i)	emission of electrons	M1	
	from heated metal/named metal/filament/wire	A1	
(ii) 1.	prevents collision with air (molecules) or prevents deflection or lets electrons/particles reach screen/travel unimpeded	B1	
2.	moves vertically (e.g. up/down/above/below or vertical line) not with horizontal movement due to this voltage	B1	
	attracted by positive or repelled by negative or attracted by one plate and repelled by the other or electric field (acts on charge)	B1	[5]
			[Total: 15]