



Cambridge International Examinations
Cambridge Ordinary Level

PHYSICS

5054/21

Paper 2 Theory

October/November 2016

MARK SCHEME

Maximum Mark: 75

Published

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Section A

- 1 (a) velocity/it has a direction/is a vector B1
- (b) (i) $(F =)ma$ or 800×1.5 C1
1200 N A1
- (ii) friction/air resistance acts on car B1
opposes force due to engine B1
- (iii) $(\Delta v =)at$ or 1.5×4.0 or 6.0 C1
31 m/s A1 [7]
- 2 (a) 260 N B1
- (b) (i) for a body in equilibrium B1
(total) clockwise moment = (total) anticlockwise moment B1
- (ii) $F_1d_1 = F_2d_2$ or 260×0.35 or 91 or $F \times 0.65$ C1
 $260 \times 0.35 = F \times 0.65$ or $260 \times 0.35/0.65$ or $91 = F \times 0.65$ or $91/0.65$ C1
140 N A1 [6]
- 3 (a) chemical (potential energy) B1
- (b) (i) non-renewable **and** oil/it is not replaced/will run out B1
- (ii) acid rain **or** produces CO₂ **or** warms lakes/rivers/sea **or** global warming **or** greenhouse effect B1
- (c) (i) useful energy output/(total) energy input **or** power for energy twice B1
- (ii) 1 $1.9 \times 10^9/0.38$ or $1.9 \times 10^9 \times 100/38$ C1
 5.0×10^9 W A1
- 2 $(E =)Pt$ or $0.62 \times 5.0 \times 10^9 \times 2.0 (\times 3600)$ or $(5.0 - 1.9) \times 10^9$ etc. C1
 2.2×10^{13} J A1 [8]
- 4 (a) smallest angle for total internal reflection **or** angle for refraction along surface B1
angle of incidence in (optically) denser medium B1
- (b) vertical ray continues undeviated B1
second ray (60° to horizontal) refracts away from normal into the air B1
third ray reflects internally **and** $i = r$ by eye **not** if any refracted ray B1 [5]

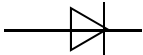
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- 5 (a) number of oscillations / vibrations / wavelengths / compressions / rarefactions / cycles per second / unit time B1
- (b) (i) ($\lambda =$) c/f or 330 / 2200 C1
0.15 m A1
- (ii) 1 no change
and
2 increases B1
- (c) (i) 1 loudspeaker vibrates / oscillates / moves to and fro (and collides with molecules) B1
2 compressions **and** rarefactions / molecules vibrate / longitudinal wave vibration / oscillation / energy passed on B1
B1
- (ii) fewer / no molecules / particles **and** less / no energy / vibration transferred B1 [8]
- 6 (a) (i) X N-pole B1
Y S-pole **and** Z N-pole B1
- (ii) they touch / move towards each other **and** opposite poles attract B1
- (b) any sensible use: starting-motor circuit; with a logic gate; nuclear power station B1
corresponding explanation: current too large for dash-board switch; current too small to power device; too dangerous to reach switch B1 [5]
- 7 (a) (i) supplies the (mains) e.m.f. / voltage B1
- (ii) to complete the circuit / is at 0 V B1
- (b) (i) the circuit / supply is cut / broken or current stops B1
fuse melts / blows / burns B1
- (ii) live wire B1
when it cuts the circuit / melts no part of the appliance is live / no shock B1 [6]

[45]

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Section B

- 8 (a) (i) 11 protons **and** 11 electrons B1
 13 neutrons B1
 electrons in orbit/surrounding nucleus **or** neutrons **and** protons in nucleus B1
- (ii) **one** more neutron (in sodium-24) **or** one fewer neutron in sodium-23 B1 [4]
- (b) (i) electron B1
- (ii) ${}_{-1}^0(\beta)$ **cao** B1
 ${}^{24}_{\dots}(\text{Mg})$ B1
 ${}^{24}_{12}(\text{Mg})$ B1 [4]
- (c) electromagnetic (radiation / rays / waves) M1
 (very) high frequency / energy **or** (very) short wavelength A1 [2]
- (d) (i) path curving upwards B1
 (ii) path continues in straight line B1
 (iii) beta-particle charged **or** gamma-ray uncharged B1 [3]
- (e) long enough **or** short enough B1
 to take measurements **or** so the body is not irradiated for long B1 [2]
[15]
- 9 (a) (i) magnetic field mentioned B1
 alternating / changing magnetic field B1
 current / voltage / e.m.f. induced (in secondary coil) B1
- (ii)  B1
 diode B1 [5]
- (b) (i) work done / energy transferred per unit charge M1
 electrical energy to other forms **or** for whole circuit **or** property of supply A1

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- (ii) 1 1.3V B1
 2 $(I =)V/R$ or 1.3/5.2 C1
 0.25 A A1
 3 $(Q =)It$ or $0.25 \times 1.5 \times 3600$ or 0.25×1.5 C1
 $0.25 \times 1.5 \times 3600$ or 0.37/0.375/0.38 C1
 1300/1350/1400 C A1 [8]
- (c) plastic/casing is an (electrical) insulator M1
 no shock possible A1 [2]
 [15]
- 10 (a) (i) molecules / they close together or small gaps between molecules B1
 (ii) molecules / they exert large (repulsive) forces B1 [2]
- (b) (i) $(V =)m/\rho$ or 680/0.85 C1
 800 cm^3 or $8.0 \times 10^{-4} \text{ m}^3$ A1
- (ii) 1 molecules vibrate molecules vibrate B1
 collide with neighbours or collide with electrons B1
 transfer vibration / energy electrons travel through metal B1
 2 heated / hot oil expands / less dense B1
 rises B1
 convection current/circulation established B1
 3 any suitable named insulator and it is a poor conductor B1 [9]
- (c) (i) temperature at which (liquid) vaporises / becomes gas / steam B1
 (ii) $(Q =)mc \Delta T$ or $680 \times 2.0 \times (260 - 20)$ or $680 \times 2.0 \times 240$ C1
 $3.3 \times 10^5 \text{ J}$ A1
 (iii) heat supplied to pan or heat lost to air / surroundings B1 [4]
 [15]