



Cambridge IGCSE™

PHYSICS**0625/41**

Paper 4 Extended Theory

October/November 2023

MARK SCHEME

Maximum Mark: 80

Published

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.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **17** printed pages.

Question	Answer	Marks
1(a)	20 J	A2
	$(\Delta.E_p =) mg(\Delta)h$ OR $0.2(0) \times 9.8 \times 10$	C1
1(b)(i)	14 J	A2
	$(E_k =) \frac{1}{2}mv^2$ OR $\frac{1}{2} \times 0.2(0) \times 12^2$	C1
1(b)(ii)	$p = mv$ OR $(\Delta p =) mv - mu$	B1
	$(\Delta p =) 0.2(0) \times \{14 + 12\}$ OR $0.2(0) \times \{14 - -12\}$ OR $p_{\text{before}} = 0.2(0) \times 14$ AND $p_{\text{after}} = 0.2(0) \times (-)12$	B1
	$(\Delta p =) 2.8 - \{-2.4\}$ $(= 5.2 \text{ kg m / s})$ OR $(\Delta p =) 0.2(0) \times \{14 - -12\}$	B1
1(b)(iii)	21 N	A2
	$(F =) \Delta p / (\Delta)t$ OR $F = (\Delta)mv / (\Delta)t$ OR $5.2 / 0.25$	C1

Question	Answer	Marks
2(a)	<i>any three from:</i> • free / delocalised / mobile electrons • (electrons) gain (thermal) energy from hotplate / particles • (electrons) move through(out) copper / metal OR (electrons) move to distant particles • electrons transfer energy from higher temperature (region) to lower temperature (region) OR (electrons) collide with (distant) particles / transfer energy to (distant) particles	B3
2(b)	(shiny surfaces are) poor emitters of radiation	B1
	reduces energy loss (from the pan / copper) OR less energy transferred to surroundings	B1
2(c)	convection	B1

Question	Answer	Marks
3(a)	particles (of liquid) are touching / close to each other	B1
	forces (of repulsion) between particles (of liquid) are large	B1
3(b)(i)	$(\Delta p =) \rho g(\Delta)h$	B1
	$1000 \times 9.8 \times 0.087$ OR $(\Delta p =) 852.6$ (Pa)	B1
3(b)(ii)	12 N	A2
	$p = F / A$ OR $(F =) pA$ OR 850×0.014	C1
3(b)(iii)	1.2 kg	A2
	$g = W / m$ OR $(m =) F / g$ OR 12 / 9.8	C1

Question	Answer	Marks
4(a)(i)	(point / place / position) where (all) the weight (seems to) acts	B1
4(a)(ii)	a small tilt / rotation makes G no longer vertically above the base OR small tilt / rotation produces moment (that topples transmitter)	B1
4(b)(i)	arrow(head) marked along wire W towards ground	B1
4(b)(ii)	moment = $F \times d$ AND correct indication of F and d on Fig. 4.1.	A3
	(moment is) force $\times$ (perpendicular) distance (from base / pivot)	C1
	(moment is) force $\times$ perpendicular distance (from base / pivot)	C1
4(c)	a use of radio waves, e.g. RFID / astronomy / Bluetooth / RADAR / wifi	B1

Question	Answer	Marks
5(a)	<i>Any three from:</i> • description of how the (energy from) water is released • mention of transfers between energy stores • (moving) water turns turbine • turbine turns / drives generator • name of method to match description	B3
5(b)	advantage of generating electricity from energy stored in water disadvantage of generating electricity from energy stored in water	B1 B1
5(c)	any two from: • geothermal (energy / power) • tidal (energy / power) • nuclear (energy / power)	B2

Question	Answer	Marks
6(a)(i)	any two from: • ray from top / bottom of object, parallel to principal axis, refracted through right-hand principal focus • straight ray from same point on object through optical centre • ray that (seems to) come from left-hand principal focus through same point of object and refracted parallel to principal axis rays traced back to intersection AND intersection / image labelled I	M2
6(a)(ii)	(distance =) 35.5 cm to 38.5 cm 7.1 to 7.7 (cm) OR (distance =) 35.0 (cm) to 40.0 (cm)	A2 C1
6(b)	virtual AND <i>any one from</i>: • cannot be projected on a screen • (real) light (ray) does not pass through image • light only seems to come from image	B1
6(c)	<i>any one from</i>: • long-sightedness focuses image behind retina / back of eye OR long-sightedness produces blurry / fuzzy images (of close objects) • converging lens reduces focal length (of eye) • (converging lens) puts image further away (from the eye) (converging lens gives) sharp/focussed image on retina / back of eye OR (with lens) rays converge on retina / back of eye	B1

Question	Answer	Marks
7(a)	electrons move from cloth to rod (plastic) rod gains electrons	A2 C1
7(b)(i)	(region) where an (electric) <u>charge</u> experiences a <u>force</u>	B1
7(b)(ii)	At least three radial field lines distributed evenly around outside of S AND touching S AND not inside S	B1
	arrow on (at least one) field line pointing towards S	B1
7(c)	arrow through Z and away from (centre of) sphere	B1

Question	Answer	Marks
8(a)(i)	900 C	A2
	$I = Q / t$ OR $(Q =) It$ OR 1.5×600	
8(a)(ii)	2.0 Ω	A3
	$R = V / I$ OR $(R_{\text{tot}} =) V / I$ OR 9.0 / 1.5 or 6.0	
	$(R_{\text{cyl}} =)$ total resistance – P OR $(R_{\text{cyl}} =) 6.0 - 4.0$	
8(b)	1200 s	A4
	R is directly proportional to l OR (new cylinder) twice as long means twice R	
	R is inversely proportional to A OR (new cylinder) half cross-sectional area means twice R	
	(resistance of cylinder $=) 4 \times$ (a)(ii) (Ω)	

Question	Answer	Marks
9(a)(i)	(americium-241 has) one neutron fewer (in the nucleus)	B1
9(a)(ii)	(different) number of protons (in nucleus)	B1
	(different) number of neutrons (in nucleus)	B1
9(b)(i)	${}_{95}^{241}\text{Am} \rightarrow {}_{93}^{237}\text{Np} + {}_2^4\text{a}$	A3
	any two from: ${}_{95}\text{Am}$ ${}_{237}\text{Np}$ ${}_2^4\text{a}$	C2
9(b)(ii)	(α -particles have) more kinetic energy (than β -particles)	B1
	(α -particles have) more charge (than β -particles)	B1
9(b)(iii)	Low(er) (initial) activity OR Few emissions per unit time	M1
	so smoke detectors are not hazardous to humans OR so disposal of old detectors is cheap / easy	A1

Question	Answer	Marks
10(a)	hydrogen nuclei fuse to become helium nuclei	A3
	nuclear reactions OR (nuclear) fusion	
	hydrogen fuses into helium	
10(b)(i)	(observed) wavelength is longer / wavelength is shifted towards the red end of the spectrum	A2
	(light from galaxy) redshifted / shifted towards red (end of spectrum)	
10(b)(ii)	<u>change</u> in wavelength (or starlight due to redshift)	B1
10(c)(i)	5.9×10^{24} m	A2
	$H_0 = v/d$ OR $(d =) v / H_0$ OR $1.3 \times 10^7 / 2.2 \times 10^{-18}$ OR 5.9×10^N (m)	
10(c)(ii)	1.4×10^{10} (years)	A2
	(age =) $1 / H_0$ or $1 / 2.2 \times 10^{-18}$ or 4.5×10^{17}	
		C1