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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics (Modular) 3453/H
Specification A

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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GCSE PHYSICS (MODULAR) 3453/H
MARK SCHEME – HIGHER TIER (TERMINAL PAPER)
SUMMER 2006

3453/H Q1

	answers	extra information	mark
(a) (i)	SETI/search for extraterrestrial intelligence		1
(ii)	a radio telescope/dish	do **not** accept robot/satellite/ radio set/computer	1
(b)	any **three** from • (living) organisms/microbes/bacteria/ microorganisms • fossils/ fossilised footprints/bones/plants • oxygen/atmosphere similar to Earth • water/ice	1 mark each accept formations caused by water	3
total			5

3453/H Q2

	answers	extra information	mark
(a) (i)	it is increasing	accept speeding up/accelerating/ getting quicker	1
(ii)	it is decreasing	accept slowing down/decelerating/ getting slower do **not** accept going backwards/ reversing/braking/stops	1
(b) (i)	**A** gradient of **A** greater than gradient **B** (1) **or** reaches a greater speed gradient of a speed-time graph = accn (1) **or** accn = change in speed/time	no mark for answer '**A**' alone if **B** stop marking accept reverse argument; slope	2
(ii)	any **two** from • initially thrust › drag or speed increases • drag increases with speed • eventually drag = thrust • acceleration = zero **Quality of written communication** 1 mark for clear linking of ideas	1 mark each accept getting faster/accelerates accept air resistance/friction **no** resultant force/forces cancel/ equal/balanced **not** level out reaches terminal velocity if forces not mentioned q = x	2 1
total			7

3453/H Q3

	answers	extra information	mark
(a) (i)	transverse		1
(ii)	longitudinal/compression		1
(b)	any **two** from • microwaves carry/transfer energy • microwaves <u>absorbed by water</u> (molecules) • water becomes hot/ molecules/particles vibrate <u>faster/more</u>	1 mark each do **not** accept molecules heat up	2
(c)	any **two** from • have the same/similar velocity • can travel through a vacuum • both transverse waves • have similar frequency/wavelengths	1 mark each, any order accept speed accept (empty) space both electro-magnetic waves lower/longer than ….	2
(d)	can be absorbed by water <u>in cells/ tissue/organs</u> (1) cells/tissue/organs may be damaged (1)	accept taken in accept heat water <u>in cells</u>/<u>body</u> accept killed **or** destroyed ignore ref to burns **or** cancer	2
total			8

3453/H Q4

	answers	extra information	mark
(a) (i)	arrow towards centre		1
(ii)	arrow towards centre		1
(iii)	arrow towards centre		1
(b)	number of passengers may be greater greater mass	heavier passengers	1 1
(c) (i)	make it travel faster	larger speed/velocity/decrease time for rotation	1
(ii)	force would be greater force depends on velocity	 $F = \frac{mv^2}{r}$	1 1
total			8

3453/H Q5

	answers	extra information	mark
(a) (i)	have shapes/coastlines which fit (quite closely) (owtte)	any order	1
	have similar rocks/fossils	do **not** accept same animals	1
(ii)	shrinking of Earth		1
	when it cooled		1
(b) (i)	(large) pieces of Earth's lithosphere/crust/ upper mantle		1
(ii)	convection currents (1)	**or** a correct description	1
	either in (Earth's) mantle/magma (1)		1
	or driven by heat released through (natural) radioactivity	**not** nuclear reactions	
total			7

3453/H Q6

	answers	extra information	mark
(a)	any **three** from • increase the speed of rotation • increase (strength of) magnetic field • increase the number of <u>turns</u> (on coil) • increase <u>area</u> of coil	1 mark each, any order accept stronger/more (powerful) magnets; reduce gap between magnets; iron core do **not** accept bigger magnets more coils insufficient	3
(b)	(increased) global warming (1) produces acid rain (1)	accept greenhouse effect/gases do **not** accept damage to ozone layer	2
total			5

3453/H Q7

	answers	extra information	mark
(a)	… 1kg … (one) second	both bits needed	1
(b) (i)	4000 F = m x a **or** 200 = 0.05 x a (1) a = F/m **or** a = 200/0.05 (1)	correct answer with no working = 3 N.B. correct answer from incorrectly recalled relationship = 0	3
(ii)	80 a = velocity change/time **or** answer to (i) = velocity change/0.02 (1) velocity change = answer to (i) x 0.02 (1)	correct answer with no working = 3 F = $\frac{\text{change in mtm}}{\text{time}}$ F x t = change in mtm N.B. correct answer from incorrectly recalled relationship = 0	3
(c)	60 (m/s) KE = ½ mv^2 **or** 90 = ½ x 0.05 v^2 (1) v^2 = 2KE/m **or** v^2 = 180/0.05 (1)	correct answer with no working = 3 N.B. correct answer from incorrectly recalled relationship = 0	3
total			10

3453/H Q8

	answers	extra information	mark
(a) (i)	light moved nearer to red end of spectrum	λ increases/frequency decreases	1
(ii)	galaxies are moving away (from us)	do **not** accept moving apart	1
(b)	it is expanding (owtte)		1
(c)	any **two** from • it (may have) started from one point • billions of years ago • with a (huge) explosion	1 mark each accept place/spot do **not** accept millions do **not** accept big bang **or** exploding star	2
total			5

3453/H Q9

	answers	extra information	mark
(a) (i)	radio waves diffract round/over hill	accept spread do **not** accept bending TV waves don't diffract round/ over hill	1
(ii)	TV waves have shorter wavelength/ are shorter	radio have longer λ	1
	shorter wavelengths diffract less	longer λ diffract more	1
(b)	1500(m)	correct answer with no working = 3	3
	$C = f \times \lambda$ **or** $3 \times 10^8 = 200k \times \lambda$ (1)		
	$\lambda = c/f$ **or** $\lambda = 3 \times 10^8/200k$ (1)	N.B. correct answer from incorrect relationship = 0	
		1.5×10^6 m (max 2 marks)	
(c)	radio waves reflected (1)	accept long or short	3
	by (layer of) the atmosphere (1)	do **not** accept satellite	
	which is charged (1)	ionosphere; TIR/diagram	
total			9

3453/H Q10

	answers	extra information	mark
(a)	atoms of same element with different nos. of neutrons	accept use of correct symbols accept … mass no./nucleon no. accept substances with …. protons …. neutrons	1
(b) (i)	helium nucleus	accept 2 neutrons & 2 protons	1
(ii)	Time for no. of (parent) nuclei/atoms to halve or time for activity to halve	accept … count rate to halve do **not** accept radioactivity to halve	1
(iii)	alpha absorbed by smoke half-life long enough to not need replacing	alpha cannot penetrate smoke	1 1
(c) (i)	(electromagnetic) waves of (very) short wavelength	high frequency waves	1
(ii)	gamma can penetrate (out of the body) short half-life so less effect on body/ long enough for tracing	**not** into …. accept source not in body long	1 1
total			8

3453/H Q11

	answers	extra information	mark
(a) (i)	25 (m/s) Mtm = m x v **or** 25000 = 1000 x v (1) V = mtm/m **or** V = 25000/1000 (1)	correct answer with no working = 3 N.B. correct answer from incorrectly recalled relationship = 0	3
(ii)	5 (s) F = change in mtm/t **or** 5000 = 25000/t (1) t = change in mtm/F **or** t = 25000/5000 (1)	correct answer with no working = 3 N.B. correct answer from incorrectly recalled relationship = 0	3
(b)	longer time (in collision) (so) force is smaller (because) F = change in mtm/ time **Quality of written communication** 1 mark for correct use of scientific terms momentum/energy and force/time	**or** air is compressed/absorbs energy less energy transferred to pedestrian	3 1
total			10

3453/H Q12

	answers	extra information	mark
(a)	120 (N) weight of barrier to pivot distance = 1.5 (1) clockwise mts = anticlockwise mts **or** 450 x 0.4 = W x 1.5 (1) rrgt: W = 180/1.5 (1) W = 120 (N)	correct answer with no working = 4 **or** counterweight mt = 180 90 (N) by using 2m for pivot distance (3 marks)	4
total			4

3453/H Q13

	answers	extra information	mark
(a)	ray **X** travels through $\mathbf{F}_2$ ray **Y** travels on unrefracted	arrows not needed arrows not needed	2
(b)	both rays produced back	dots not necessary pt. labelled I sufficient	1
(c)	(real) rays do not pass through image/ are divergent	**or** the image I is where the rays seem/appear to come from accept image cannot be formed on a screen. (consistent with diagram) object between F_1 and lens image is upright do **not** accept image on same side as object	1
total			4