CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

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0654 CO-ORDINATED SCIENCES

0654/33

Paper 3 (Extended Theory), maximum raw mark 120

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 will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Pag	ge 2	Mark Scheme Syllabus	X
		IGCSE – October/November 2012 0654	20
(a)	(i)	two (complete) sets of/23 pairs/46, chromosomes ;	ambri
	(ii)	fertilisation ;	19
(b)	(i)	A ; D ;	[2]
	/::\	it has notals :	
	(11)	stigma is, enclosed/inside petals/not feathery; anthers/stamens are, enclosed/inside petals; so wind cannot reach them/wind cannot blow away pollen; so insect must crawl past, anther/stigma (to reach nectar);	[3]
(c)	met refe	hod of dispersal (wind, animals, water, self) ; erence to feature of fruit that aids dispersal :	
	des	cription of how the feature aids dispersal ;	[3]
			[Total: 10]
(a)	(i)	78(%);	[1]
	(ii)	different boiling points ; gases boil off as their boiling point is reached/gases boil off separately ;	[2]
(b)	(i)	transition ;	[1]
	(ii)	improves (catalyst) efficiency/increases reaction rate ; increases (catalyst) surface area ;	
		reactions occur on catalyst surface ;	[max 2]
((iii)	nitrogen and hydrogen ;	[1]
((iv)	idea that conversion of reactants through reactor is incomplete/economic/environmental argument for recycling reactants/reference. to equilibrium/reversible reaction ;	[1]
(c)	(i)	force of attraction between, nuclei/protons, and electrons ; because, opposite electrical/positive and negative, charges (attract) ; energy/work, required to move particles apart against force of attraction ;	[max 2]
	(ii)	idea that (relatively) <u>large</u> amount of energy required (to break bond)/difficult to break bond ; because high force of attraction ;	
		because, many/3 pairs/6, shared electrons/electrons in the bond,/idea that bond is a large negative charge ;	[max 2]
			ITotal: 12

Page 3 Mark Scheme Syllabus IGCSE - October/November 2012 0654 (a) A - constant/steady, speed/velocity ; B - acceleration ; (a) (a) (a) - (a)											4	222		
 (a) A - constant/steady, spee/velocity; B - acceleration; (b) (distance = 20 × 90 =) 1800 (m); (work done =) force × distance; = 1000 × 1800 = 1800 000 J; (c) (i) (acceleration =) <u>change in</u> speed + time = 33/11; = 3 m/s²; (ii) (force =) mass × acceleration; = 950 × 3 = 2850 N; (iii) the faster a car goes the greater the air resistance / frictional force; (eventually) air resistance balances (maximum) driving force; (iii) the faster a car goes the greater the air resistance / frictional force; (eventually) air resistance balances (maximum) driving force; (iii) longitudinal; (i) ongitudinal; (ii) reference to water having a smooth surface; bats receive fewer echoes from a smooth surface; other reasonable explanation; (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats; so moths with the, genes/behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes/behaviour; (ii) travel along sensory neurone; to muscles; (iii) travel along motor neurone; to muscles; 	Pag	je 3		IGCSE	Marl	k Scheme	mber 2(012		Sylla	bus	P	b. Y	
 (b) (distance = 20 × 90 =) 1800 (m); (work done =) force × distance; = 1000 × 1800 = 1800000 J; (c) (i) (acceleration =) <u>change in</u> speed + time = 33/11; = 3 m/s²; [2] (ii) (force =) mass × acceleration; = 950 × 3 = 2850 N; [2] (iii) the faster a car goes the greater the air resistance / frictional force; (eventually) air resistance balances (maximum) driving force; [2] (iii) the faster a car goes the greater the air resistance / frictional force; (eventually) air resistance balances (maximum) driving force; [2] (iii) any number above 20 000 Hz; [1] (i) longitudinal; [1] (b) (i) more drinking attempts from smooth than rough; use of figures / almost no attempts from rough; [2] (ii) reference to water having a smooth surface; sound waves scattered in many directions from a rough surface / not scattered in many directions from a rough surface / not scattered in many directions from a rough surface / not scattered in many directions from a smooth surface; bats receive fewer echoes from a smooth surface; other reasonable explanation; [max 2] (c) (i) moths with the, genes / behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats; so moths with the, genes / behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes / behaviour; [max 4] (ii) <u>travel along</u> sensory neurone; to the central nervous system / brain; <u>travel along</u> motor neurone; to muscles; [max 3] 	(a) /	A – B –	constant/ accelerati	steady, sp on ;	beed/ve	elocity ;							aCambr	:00
 (c) (i) (acceleration =) <u>change in</u> speed + time = 33/11; = 3m/s²; [2] (ii) (force =) mass × acceleration; = 950 × 3 = 2850 N; [2] (iii) the faster a car goes the greater the air resistance/frictional force; (eventually) air resistance balances (maximum) driving force; [2] (iii) the faster a car goes the greater the air resistance/frictional force; [2] (iii) the faster a car goes the greater the air resistance/frictional force; [2] (iii) the faster a car goes the greater the air resistance/frictional force; [2] (iii) any number above 20 000 <u>Hz</u>; [1] (i) longitudinal; [1] (b) (i) more drinking attempts from smooth than rough; use of figures/almost no attempts from rough; [2] (ii) reference to water having a smooth surface; sound waves scattered in many directions from a rough surface/not scattered in many directions from a smooth surface; bats receive fewer echoes from a smooth surface; other reasonable explanation; [max 2] (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats; so moths with the, genes/behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes/behaviour; [max 4] (ii) travel along sensory neurone; to the central nervous system/brain; travel along motor neurone; to muscles; [max 3] 	(b) (((dist (wol = 10	tance = 20 rk done =))00 × 1800	• × 90 =) 1 force × di) = 1 800 0	800 (m) stance 00 J ;); ;							[;	3]
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 (iii) the faster a car goes the greater the air resistance /frictional force ; [2] (eventually) air resistance balances (maximum) driving force ; [2] [Total: 10] (a) (i) any number above 20 000 Hz; [1] (ii) longitudinal ; [1] (b) (i) more drinking attempts from smooth than rough ; use of figures/almost no attempts from rough ; [2] (ii) reference to water having a smooth surface ; sound waves scattered in many directions from a rough surface/not scattered in many directions from a smooth surface ; bats receive fewer echoes from a smooth surface ; bats receive fewer echoes from a smooth surface ; other reasonable explanation ; [max 2] (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats ; so moths with the, genes to their offspring ; over time/over many generations, most moths will have the, genes/behaviour ; [max 4] (ii) travel along sensory neurone ; to the central nervous system/brain ; travel along motor neurone ; to muscles ; [max 3] 	(i	(ii)	(force =) = 950 × 3	nass × ac = 2850 N	celerati ;	on ;							[2	2]
 [Total: 10] (a) (i) any number above 20000 <u>Hz</u>; (ii) longitudinal; (i) nore drinking attempts from smooth than rough; (ii) more drinking attempts from smooth than rough; (ii) reference to water having a smooth surface; sound waves scattered in many directions from a rough surface/not scattered in many directions from a smooth surface; (ii) reference to water having a smooth surface /more echoes from a rough surface; other reasonable explanation; (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats: so moths with the, genes/behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes/behaviour; (ii) travel along sensory neurone; to the central nervous system/brain; travel along motor neurone; to muscles; (iii) travel along motor neurone; (iii) travel along sensory neurone; (iii) muscles; 	(ii	ii)	the faster (eventual	a car goe y) air resis	s the gr stance t	eater the a balances (air resis maximu	tance. ım) dri	friction	al force ce ;	Э;		[;	2]
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 (ii) reference to water having a smooth surface; sound waves scattered in many directions from a rough surface/not scattered in many directions from a smooth surface; bats receive fewer echoes from a smooth surface/more echoes from a rough surface; other reasonable explanation; [max 2] (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats; so moths with the, genes/behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes/behaviour; [max 4] (ii) <u>travel along</u> sensory neurone; to the central nervous system/brain; <u>travel along</u> motor neurone; to muscles; [max 3] 	(b) ((i)	more drin use of fig	king atterr ures/almo	npts fror ost no at	n smooth ttempts fro	than rou m roug	ugh; h;					[;	2]
 (c) (i) moths with the, genes/behaviour, are more likely to <u>survive</u>; because they are less likely to be killed by bats; so moths with the, genes/behaviour, are more likely to reproduce; and pass their genes to their offspring; over time/over many generations, most moths will have the, genes/behaviour; [max 4] (ii) <u>travel along</u> sensory neurone; to the central nervous system/brain; <u>travel along</u> motor neurone; [max 3] 	(1	(ii)	reference sound w scattered bats rece surface ; other reas	to water h aves sca in many d ive fewer e sonable ex	naving a ttered lirection echoes kplanatio	a smooth s in many is from a s from a sm on ;	urface directic mooth s ooth su	; surface irface/	om a e ; more e	rough choes	surfac	e/not rough	[max :	2]
 (ii) <u>travel along</u> sensory neurone ; to the central nervous system/brain ; <u>travel along</u> motor neurone ; to muscles ; [max 3] 	(c) ((i)	moths with because so moths and pass over tinn genes/be	h the, gen hey are le with the, g their gene he/over haviour ;	es/beh ess likely genes/b es to the many	aviour, are y to be kille behaviour, sir offspring generatio	e more l ed by ba are mo g ; ons, n	likely t ats ; ore like nost	o <u>surviv</u> ly to rep moths	<u>e</u> ; produce will	e ; have	the,	[max 4	4]
	(i	(ii)	travel alo to the cer travel alo	<u>าg</u> sensory itral nervo าg motor r	y neuro us syste neurone	ne ; em/brain ; ;							Imov ⁴	21
				э,									Tetel: di	וט

Page 4	4 Mark Scheme	Syllabus
- J-	IGCSE – October/November 2012	0654 242
(a) (i)	ions separated ; randomly spread throughout the solution ;	Sambrid
(ii)	metal atoms form ions by losing (outer shell) elect calcium ions have 2 more protons than there are elect sodium ions have 1 more proton than there are elect (accept numerical answers based on atomic numb	rons ; electrons ; ectrons ; pers) [max 2]
(b) (i)	calculates M_r of BaSO ₄ as 137 + 32 + (16 × 4) = 2 calculates moles as 4.66 ÷ 233 = 0.02 ;	233 ; [2]
(ii)	states/implies that 0.02 moles magnesium sulfate calculates mass of 0.02 moles $MgSO_4$ as 120 × 0.	; in original solution ; .02 = 2.4 g ; [2]
		[Total: 8]
(a) (i)	alternating current/owtte ; which changes 50 times per second ;	[2]
(ii)	power = voltage x current/(I =) P/V ; current = 2000 ÷ 250 = 8 A ;	[2]
(b) (i)	particles separate/escape ; more energetic particles escape (from surface) ; able to overcome attractive forces of other particle	es ; [max 2]
(ii)	conduction ; particles nearest heater (element) gain energy and vibrations/heat/energy, passed from particle to p reference to energy passing via mobile electrons ;	d vibrate more ; article along the metal ; ; [max 2]
(c) sol liqu	id has particles touching in regular arrangement ; uid has most particles touching in random arrangem	ient ; [2]
(d) (en = 3	lergy =) mass × shc × <u>change in</u> temperature ; 5 × 4200 × 40 ;	
= 5	04000J;	[3]
		[Total: 13]
(a) (i)	amylase ;	[1]
(ii)	mouth/salivary glands/pancreas;	[1]
(b) (i)	absorb amino acids ; absorb glucose ;	
	which dissolve in blood (plasma) ;	[max 2]

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Pa	age (5	Mark Scheme Svila	bus ⁷ , ⁰ , ¹ r
	age (<u> </u>	IGCSE – October/November 2012 065	64 %p
	(ii)	abso	orb, fats/fatty acids/glycerol ;	Canner.
	(iii)	incre incre	ease surface area ; ease rate of absorption ;	age con
(c)	tak cha (gly	en up anged /coge	by liver <u>cells</u> ; to glycogen ; n) stored ;	[max 2]
		Ū		[Total: 9]
(a)	dia inc ide res	gram luding a tha pect t	shows close packed regular pattern of spheres ; some with a different diameter disrupting structure ; t different sized atoms make it more difficult for atoms to o one another ; force is applied :	o move with
(b)		₂ S +	$O_2 \rightarrow 2Cu + SO_2;$	[1]
(c)	(i)	copp	per sulfate ;	[1]
	(ii)	(son at ar copp at ca	ne copper from) the anode has <u>dissolved</u> ; node Cu \rightarrow Cu ²⁺ (+ 2e ⁻) ; per has deposited on the cathode ; athode Cu ²⁺ (+ 2e ⁻) \rightarrow Cu ;	[max 2]
	(iii)	impu only impu	ure copper is made the anode ; copper, (atoms) deposit on/ions discharge at, the cathode/c urities, fall out/are not deposited/owtte ;	owtte ; [max 2]
				[Total: 9]
(a)	turi ren	ns ato noval	oms into ions/charged particles, /atoms become charged ; of electrons ;	[2]
(b)	X-r scr	ays ca een s	an damage cells ; tops X-rays passing through ;	[2]
(c)	(3 :	× 10 ⁸ ı	m/s) because all <u>electromagnetic</u> waves travel at same spee	d ; [1]

Pa	<u>ae 6</u>	Mark	Scheme	Syllabus 4	
ιa	ge v	IGCSE – Octob	er/November 2012	0654	Da
(d)					Can
			not dangerous		stidge.c
	α (a		stopped by paper		2011
	β (t	beta)	least ionising		
	γ(ga	amma)	travels up to 1 metre in	air	
	all three	e correct two marks, two o	correct one mark ;;		[2]
					ITatal: 71
	addition to meso	nal detail about xylem in r ophyll cells in leaves ;	oot/stem/leaf ;		[max 3]
(b)	(i) to to for	make amino acids/DNA ; make proteins ; ⁻ growth/to build cells/to r	nake enzymes ;		[max 2]
	(ii) no wa ou hig be	osmosis (into roots) ; ater potential outside lowe tside lower than water gher than ion concentratio cause high concentration	r than water potential inside concentration, inside / ion c n inside ; of (dissolved) ions reduces ;	/ water concentration concentration outside water potential ;	[max 2]
((iii) fer wh ba ba fisl	rtiliser causes growth of, a nich, shade out other plant icteria, feed on/decompos icteria use oxygen (for res h die <u>from lack of oxyg</u> en	lgae/plants; ts/die/decompose/decay; se, dead plants/increase in t piration); ;	pacterial growth ;	[max 3]
					[Total: 10]
1 (a)	nucleus	s and 6 protons and 6 net	utrons indicated ; guration :		[2]

(b) diamond very hard and graphite softer/flaky;

					my	
Pa	ige 7		Mark Scheme		Syllabus	·A ·
		IGCSE –	October/Novembe	er 2012	0654	They are
	dial bor diag at c onl diag diag diag diag diag diag diag	nond has C atoms a ded into the structuram; onds in diamond are weat ohite arranged in layer agram; weak forces between nond poor conductor <u>a</u> nond has C atoms a ded into the structuram; valence) electrons in the ohite arranged in layer	Il interconnected in ire/one huge ma very strong ; is (of hexagonally b a layers (allows layer and graphite good o Il interconnected in re/one huge mad bonds ; is (of hexagonally b	n three dimens cromolecule/re onded C atoms ers to slide) ; conductor ; n three dimens cromolecule / re	sional array/all ato asonable attempt)/reasonable atte sional array/all ato asonable attempt s)/reasonable atter	oms at mpt oms t at
	free (rej	electrons between laget reference to meltin	yers ; g point)			[max 4
(c)	(i)	alkanes ; only single bonds/sa	turated/fits general	∣ formula C₂H₂n+	-2;	[2]
	(ii)	gasoline burns to pr effect/climate change gasoline burns to pro pollutants (which hav bydrogen waste prod	roduce carbon dio e ; duce pollutants suc e adverse effects o uct is (non-polluting	xide which is l ch as carbon m n health) ; 1) water :	linked to greenho onoxide/other nar	use ned
		nyulogen waste plou		j) water,		[3
						[Total: 11]
(a)	hea ste	t energy turns water ir m/kinetic energy, driv	nto steam / heats C0 ves turbine (which o	D ₂ ; drives generator	r);	[2]
(b)	slip coil rev ma	rings ; connections are not i rses as coil turns ; ntain connection/avoi	reversed/slips ring d wires twisting ;	s rotate with cc	bil/direction of cur	rent [max 2]
(c)	(i)	Vp/Vs = Np/Ns ; Ns = 40000 × 40000 = 640000 (turns) ;	0/25000;			[3]
	(ii)	to enable transformer	s to change voltage	e/transformers	only work with a.c.	.; [1]
						[Total: 8
						L. etan O