Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/43**

Paper 4 Theory (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 120

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 May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: the specific content of the mark scheme or the generic level descriptors for the question the specific skills defined in the mark scheme or in the generic level descriptors for the question the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate marks are awarded when candidates clearly demonstrate what they know and can do marks are not deducted for errors marks are not deducted for omissions answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	9 ;	**1**
1(a)(ii)	enzyme denatures ; shape of active site changes ; substrate no longer fits into enzyme / active site, **or** substrate and enzyme / active site are no longer complimentary ;	**3**
1(b)	particles move faster / increased kinetic energy (of the particles) ; at higher temperature greater frequency of collision ; more successful collisions ;	**3**
1(c)(i)	carbon, hydrogen, oxygen, nitrogen ;	**1**
1(c)(ii)	add biuret solution ; solution would turn purple ;	**2**

Question	Answer	Marks
2(a)	**A** fractional distillation ; **B** cracking ; **(C** catalytic addition) **D** addition polymerisation ;	**3**
2(b)	boiling point (range) ;	**1**
2(c)	endothermic ; bond breaking takes in energy / is an endothermic process **and** bond formation gives out energy / is an exothermic process ; more energy taken in than given out ;	**3**
2(d)	high temperature ; high pressure ;	**2**
2(e)(i)	ethene is monomer ; many (monomers / molecules) join to make (long chain) polymer ;	**2**
2(e)(ii)	poly(ethene) is not an alkene / does not have double bond / is saturated ;	**1**

Question	Answer	Marks
3(a)(i)	**Q** is greater than **S** ;	**1**
3(a)(ii)	**R** ;	**1**
3(a)(iii)	gravitational ;	**1**
3(b)	(acceleration =) change in speed/time **or** 50 / 40 ; = 1.3 / 1.25 ; m/s^2 ;	**3**
3(c)	kinetic **and** gravitational potential energy ;	**1**
3(d)(i)	region of high pressure / where particles are closer together ;	**1**
3(d)(ii)	distance between two successive compressions ;	**1**

Question	Answer	Marks
4(a)(i)	4 ;	**1**
4(a)(ii)	green algae / phytoplankton ;	**1**
4(a)(iii)	green algae → limpets → crab → herring gull / phytoplankton → mussels → crab → herring gull correct order of organisms ; correct direction of arrows ;	**2**
4(b)	limpet population decreases (no mark) crabs lose a source of food ; increased predation of limpets ;	**2**
4(c)	chemical ; nutrient **and** energy ;	**2**

Question	Answer	Marks
5(a)(i)	rate decreases ; acid (particles) used up / concentration decreases ; frequency of particle collision decreases ;	**3**
5(a)(ii)	steeper initially **and** plateaus earlier ; same final volume ;	**2**
5(b)(i)	0.070 ;	**1**
5(b)(ii)	(0.070 / 24) = 0.0029 ; (0.0029 · 2) = 0.0058 ; (0.0058 / 0.50) = 0.012 ;	**3**
5(c)	1:1 ;	**1**

Question	Answer	Marks
6(a)	25 / 22 (· 10^{-4}) ; conversion of cm^2 to m^2 seen ; = 11 000 (N/m^2) ;	**3**
6(b)	0.67 / 0.50 ; 1.3 ;	**2**
6(c)(i)	3.0 / 6.0 ;	**1**
6(c)(ii)	f 1.5 / 0.5 ; = 3 (Hz) ;	**2**
6(d)(i)	cancer / mutation ;	**1**
6(d)(ii)	α particles are larger/heavier ; α particles have positive charge **and** β particles have negative charge ; α particles are more ionising ; α particles are less penetrating ;	**max 2**
6(d)(iii)	$^{28}_{13}\mathrm{A}l$ 1 mark for Al ; 1 mark for 13 **and** 28 in correct positions ;	**2**

Question	Answer	Marks
7(a)	green parts photosynthesise ; (photosynthesis) produces glucose ; glucose turned to starch ; starch turns iodine blue-black / reacts with iodine ;	**max 3**
7(b)	magnesium ;	**1**
7(c)	ref to translocation ; as sucrose ; in the phloem ; from, source / regions of production / leaf, to, sink / regions or storage / where they are used in respiration / examples, / growth ;	**max 3**
7(d)	CO_2 ;	**1**
7(e)	cohesion ;	**1**

Question	Answer	Marks
8(a)(i)	2, 8, 1 ;	**1**
8(a)(ii)	number of valence / outer shell, electrons equals group number **or** sodium has 1 outer electron so is in group 1 ;	**1**
8(b)(i)	green to blue / violet ; (sodium hydroxide is) alkaline / pH increases / pH becomes >7 ;	**2**
8(b)(ii)	similarity **and** difference: hydrogen / hydroxide / alkali also formed **and** more vigorous reaction ; similarity explanation: elements in same group have similar properties ; **or** same number/one electron in outer shell (so react similarly) ; difference explanation: trend to greater reactivity down Group I ; **or** outer electron more easily lost/further from nucleus (so more reactive) ;	**3**
8(c)	Na^+ **and** Cl^- in equal numbers (+1Cl^-); alternating in both directions ;	**2**

Question	Answer	Marks
9(a)	particles in a gas are not/weakly bonded ; particles in a gas move further apart ;	**2**
9(b)	two different metals joined together ;	**1**
9(c)(i)	(R =) V / I **or** 230 / 2.0 ; = 120 / 115 (Ω) ;	**2**
9(c)(ii)	(E =) V · I · t **or** 230 · 2.0 · 1200 ; 550 000 / 552 000 (J) ;	**2**
9(c)(iii)	stronger forces of attraction between molecules in liquid water ; molecules are closer together in liquid water ; molecules in liquid water move around each other **or** molecules in steam move throughout the gas / move further between collisions ;	**3**

Question	Answer	Marks
10(a)(i)	in humans: blood travels through the heart twice in one circuit of the body / double circulation / circulation to the lungs and to the body ; heart has two atria / ventricles ; oxygenated and deoxygenated blood in the heart / (only) deoxygenated in fish heart ; lungs instead of gills ;	**max 3**
10(a)(ii)	septum ;	**1**
10(b)	large surface area ; thin surface ; good blood supply ;	**max 2**
10(c)	correct ref to vasodilation / arterioles widen ; arterioles supply more blood to the capillaries in the skin surface ; (vasodilation) increases rate of thermal energy / heat loss from the skin; ;	**3**

Question	Answer	Marks
11(a)	carbon / coke ;	**1**
11(b)(i)	carbon monoxide ;	**1**
11(b)(ii)	Fe^{3+} / iron <u>ions</u> gain <u>electrons</u> ; forming Fe / iron <u>atoms</u> ;	**2**
11(c)	calcium oxide **and** carbon dioxide ; silicon dioxide **and** calcium oxide ; slag ;	**3**
11(d)(i)	aluminium is too reactive ;	**1**
11(d)(ii)	oxide layer on surface ;	**1**

Question	Answer	Marks
12(a)	useful energy output/total energy input · 100 **or** 3 / 8 · 100 ; = 37.5% ;	**2**
12(b)	(charge = current x time = 3 · 180 =) 540 (C) ;	**1**
12(c)(i)	split ring commutator ;	**1**
12(c)(ii)	arrow from N pole to S pole ;	**1**
12(c)(iii)	current produces magnetic field (around coil) ; magnetic field interacts with other magnetic field ; force exerted (on current carrying conductor in magnetic field) ;	**3**

Question	Answer	Mark
13(a)	as temperature increases, the time (taken for dye to spread across the petri dish) decreases ;	**1**
13(b)	reference to diffusion ; the red dye particles move, from an area of high concentration to an area of low concentration / down a concentration gradient ; by random movement of particles ; until particles evenly distributed / until dye particles move into the centre at the same rate as they move out ;	**max 3**