CO-ORDINATED SCIENCES	**0654/31**
Paper 3 Theory (Extended)	**October/November 2016**
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.
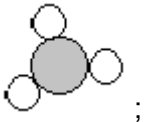
Cambridge will not enter into discussions about these mark schemes.

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Question	Answer	Marks
1(a)(i)	nitrogen ; oxygen ;	**2**
1(a)(ii)	little / no overall change then increases ; some fluctuations ; increases from 1800 ; by 0.0065% ;	**max 3**
1(b)(i)	respiration / decomposition / excretion ;	**1**
1(b)(ii)	photosynthesis ;	**1**
1(c)	(increased:) burning of fossil fuels ; deforestation ; industrialisation ; human population / activity ;	**max 2**
1(d)	measure content of air at present ; measure sample from most recent ice ;	**2**
1(e)	absorbs radiation / IR / heat / energy ; radiates back to Earth ;	**2**
	Total:	**13**

Question	Answer	Marks
2(a)(i)	D AND hydrogen ;	**1**
2(a)(ii)	C AND carbon dioxide ;	**1**
2(a)(iii)	B AND copper (too) unreactive (to displace hydrogen from dilute acid) / copper less reactive than hydrogen ;	**1**
2(a)(iv)	A AND barium sulfate ;	**1**
2(b)(i)	28 ; 23 ;	**2**
2(b)(ii)	transition (series / metals) ;	**1**
2(b)(iii)	;	**1**
2(b)(iv)	$2SO_2 + O_2 \rightarrow 2SO_3$ formulae ; balanced ;	**2**
	Total:	**10**

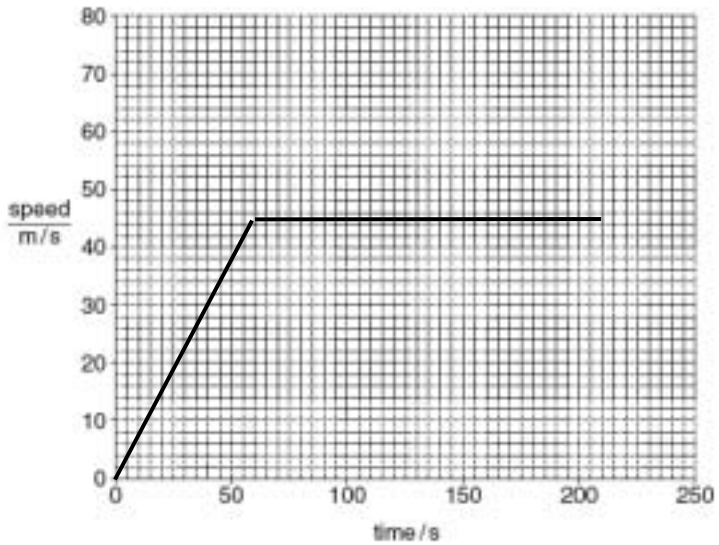| Question	Answer	Marks
3(a)(i)	some of the water in kettle C has boiled away / evaporated ;	1
3(a)(ii)	latent heat (of vaporisation) / (energy required) to separate molecules from each other ;	1
3(a)(iii)	evaporation can occur at any temperature / boiling only happens at the boiling point ; evaporation happens only at the surface / boiling happens throughout the liquid ; boiling takes energy in (endothermic) to occur / evaporation lets only the molecules with the highest kinetic energy out ; evaporation can occur using the internal energy of the system / boiling requires an external source of heat ; evaporation produces cooling / boiling does not ; evaporation is a slow process / boiling is a rapid process ;	max 2
3(a)(iv)	(water is) B AND most particles are touching and random arrangement ; (water vapour is) C AND particles are spread out (and random arrangement) ;	2
3(b)	convection ; heated water is less dense / expands ; hot water rises ;	max 2
3(c)	(I) = P / V ; = 2000 / 250 (= 8 A) ;	2
	Total:	10

Question	Answer	Marks
4(a)	mitosis ;	1
4(b)(i)	identical ;	1
4(b)(ii)	similar ;	1
4(c)	retains humid air around the cutting ; reduces water loss / transpiration ;	2
4(d)(i)	stunted growth ;	1
4(d)(ii)	yellow leaves ;	1
	Total:	**7**

Question	Answer	Marks
5(a)(i)	(zinc) changes from grey to darker grey / brown / pink ; copper forms on the surface ; OR (copper sulfate) changes from blue to less blue / colourless ; copper (ion) is removed / displaced from the solution / owtte ;	**2**
5(a)(ii)	(26) this is iron ; metal M less reactive than zinc but more reactive than copper / silver ; the other metals (are sodium and calcium which) are both more reactive than zinc ;	**max 2**
5(b)(i)	aqueous / water solution ;	**1**

Question	Answer	Marks
5(b)(ii)	zinc (atoms) lose electrons and are oxidised ; silver (ions) gain electrons and are reduced ;	**2**
5(c)	increases / gets faster / goes up ; exothermic ; chemical / chemical potential ;	**3**
	Total:	**10**

Question	Answer	Marks
6(a)(i)	Acceleration line gradient correct ; Constant velocity line correct at 45 m / s for 150 s anywhere ; 	**2**

Question	Answer	Marks
6(a)(ii)	Area under graph / AVP ;	**1**
6(b)	Speed = 45 m / s ; KE = ½ mv^2 / ½ × 6.0 × 10^5 × 45 × 45 ; 6.1 × 10^8 (J) ;	**3**
6(c)	Force = mass × acceleration / ma / 6.0 × 105 × 0.75 ; 4.5 × 10^5 (N) ;	**2**
	Total:	**8**

Question	Answer	Marks
7(a)	environment ; negative ; (3rd line) away from AND towards ;	**3**
7(b)(i)	12.30 ;	**1**
7(b)(ii)	Eats a meal ;	**1**
7(b)(iii)	respiration ; glycogen synthesis ; insulin secretion ;	**max 2**
7(c)	liver converts glucose to glycogen / glycogen to glucose ; liver stores glycogen ; insulin causes uptake of glucose ; glucagon causes release of glucose ;	**max 3**
	Total:	**10**

Question	Answer	Marks
8(a)(i)	2– ; gains 2 electrons to complete outer shell ; more (negative) electrons than (positive) protons ;	**3**
8(a)(ii)	2+ ; reference to the need for charge balance ;	**2**
8(b)	zinc <u>ions</u> are attracted / move to the cathode ; zinc <u>ions</u>, gain electrons / are discharged, at the cathode ;	**2**
8(c)(i)	galvanised ;	**1**
8(c)(ii)	sacrificial protection / sacrificial barrier ; (if steel exposed) zinc rather than steel corrodes ; because zinc more reactive (than iron) ;	**max 2**
8(d)	malleable refers to ability to be shaped (without breaking) ;	**1**
	Total:	**11**

Question	Answer	Marks
9(a)(i)	fission is splitting of <u>nuclei</u> <u>and</u> fusion is joining of <u>nuclei</u> ;	**1**
9(a)(ii)	$^{239}_{94}\text{Pu} \rightarrow {}^{235}_{92}\text{U} + {}^{4}_{2}\alpha$ $^{4}_{2}\alpha$ / $^{4}_{2}\text{He}$; $_{92}\text{U}$; Nucleon number of daughter nuclide: 235 ;	**3**
9(b)(i)	reduces energy / power losses ;	**1**

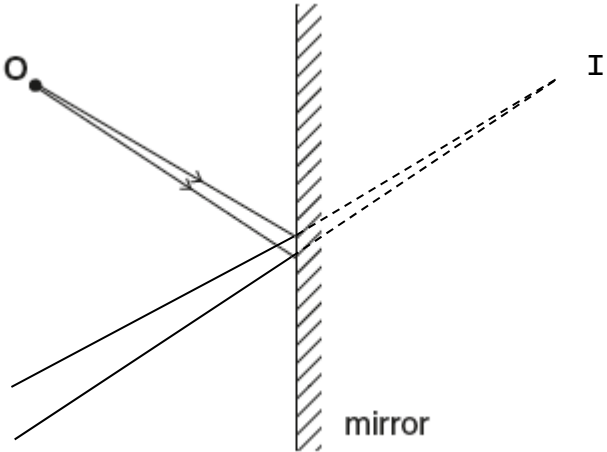| Question	Answer	Marks
9(b)(ii)	$Ns = Np \times Vs / Vp$; $= 5000 \times 600\,000 / 25\,000$; $= 120\,000$;	**3**
9(c)(i)	resistance decreases / any answer in the range $0 < R < 6.5$; resistance is halved / 3.25 ohms ;	**2**
9(c)(ii)	material / temperature ;	**1**
9(c)(iii)	cable will have greater, mass / weight / heavier ; more force on pylons / need stronger pylons / heavier cables damage pylons ;	**2**
	Total:	**13**

Question	Answer	Marks
10(a)(i)	X = placenta ; Y = amniotic fluid ; Z = umbilical cord ;	**3**
10(a)(ii)	protection ;	**1**
10(a)(iii)	less oxygen ; less (named) nutrient(s) ; more CO_2 ; more urea ;	**max 3**
10(b)(i)	antibodies from mother ; mother-baby bonding ; correct <u>balance of</u> nutrients ; no need for sterilising equipment ;	**max 2**

Question	Answer	Marks
10(b)(ii)	know how much the baby has had ; no need for presence of mother ; less chance of transfer of disease from mother ;	**max 1**
	Total:	**10**

Question	Answer	Marks
11(a)	cobalt chloride paper turns pink ; showing water (vapour) (in the combustion products) ; limewater turns milky ; showing carbon dioxide (in the combustion products) ;	**4**
11(b)	ethene and water / steam ;	**1**
11(c)(i)	$(12 \times 2) + (1 \times 6) + (1 \times 16)(= 46)$;	**1**
11(c)(ii)	calculate number of moles in $0.25\,dm^3$: $0.5 \div 4 = 0.125$; calculate mass of ethanol $= 46 \times 0.125 = 5.75$; units are g ;	**3**
	Total:	**9**

Question	Answer	Marks
12(a)(i)	;	1
12(a)(ii)	travel at same speed ;	1
12(a)(iii)	(more) ionising ;	1
12(b)	4 or 3 correct = 2 marks , 2 or 1 correct = 1 mark ;;	2

Question	Answer	Marks
12(c)(i)	reflected rays correctly drawn ;	1
12(c)(ii)	construction lines drawn behind mirror and image correctly located ; 	1
12(d)(i)	focal length correctly identified ;	1
12(d)(ii)	refraction ;	1
	Total:	**9**