2014 Senior External Examination

Physics

Paper Two — Resource book

Monday 10 November 2014

1 pm to 3:10 pm

Directions

You may write in this book during perusal time.

Contents

- Formulas
- · Physical constants
- · Periodic table
- List of elements by name

After the examination session

Take this book when you leave.



Planning space

Formulas

1 0111	ididə
$v_{av} = \frac{s}{t}$	$n_1 v_1 = n_2 v_2$
$a_{\rm av} = \frac{\Delta v}{t}$	$v = f\lambda$
v = u + at	$E = \frac{kq}{d^2}$
$s = \frac{1}{2} (u + v) t$	$F = \frac{kq_1q_2}{d^2}$
$s = ut + \frac{1}{2} at^2$	$E = \frac{F}{q}$
$v^2 = u^2 + 2as$	V = Ed
F = ma	q = It
$a_c = \frac{v^2}{r}$	V = IR
$F = \frac{Gm_1m_2}{r^2}$ $P = \frac{W}{t}$	P = VI
$P = \frac{W}{t}$	W = VIt
$KE = \frac{1}{2} mv^2$	$R = R_1 + R_2 + \dots$
$PE = \frac{1}{2} kx^2$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
PE = mgh	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$ $\beta = \frac{I_C}{I_B}$
F = kx	$F = BILsin\theta$
$W = Fs \cos \theta$	$F = Bqv sin \theta$
$p = mv = F\Delta t$	$B = \frac{KI}{r}$
$d\sin\theta = \frac{dx_n}{L} = n\lambda$	$B = 2\pi KIN$ (N = no. of turns per unit length)
$d\sin\theta = \frac{dx_n}{L} = \left(n - \frac{1}{2}\right)\lambda$	$\phi = BA\cos\theta$
$\frac{V_p}{V_s} = \frac{I_s}{I_p} = \frac{N_p}{N_s}$	$\varepsilon = \frac{-\Delta \phi}{\Delta t}$
$\sin \theta_{\rm c} = \frac{\rm n_2}{\rm n_1}$	$\varepsilon = BLv$
$\Delta x = \frac{L\lambda}{d}$	E = hf
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	KE = hf - W

Blank page		

Physical constants

Acceleration due to gravity (g) = 9.80 ms^{-2}

Universal gravitational constant (G) = $6.67 \times 10^{-11} \text{ Nm}^2 \text{kg}^{-2}$

Speed of light (c) = $3.00 \times 10^8 \text{ ms}^{-1}$

Refractive index of air = 1.00

Radius of Earth = $6.38 \times 10^6 \text{ m}$

Earth–Moon separation = $3.85 \times 10^5 \text{ km}$

Earth–Sun separation = $1.50 \times 10^8 \text{ km}$

Mass of Earth = $5.98 \times 10^{24} \text{ kg}$

 $Mass of Moon = 7.35 \times 10^{22} \text{ kg}$

Mass of Sun = $1.99 \times 10^{30} \text{ kg}$

Ampère's constant (K) = $2.00 \times 10^{-7} \text{ NA}^{-2}$

Coulomb's constant (k) = $9.00 \times 10^9 \text{ Nm}^2\text{C}^{-2}$

Planck's constant (h) = $6.63 \times 10^{-34} \text{ Js}$

Mass of proton = $1.67 \times 10^{-27} \text{ kg}$

Mass of neutron = $1.68 \times 10^{-27} \text{ kg}$

 $1 \text{ eV} = 1.60 \text{ x } 10^{-19} \text{ J}$

Mass of electron = $9.11 \times 10^{-31} \text{ kg}$

Charge on electron = $-1.60 \times 10^{-19} \text{ C}$

Periodic table

*
$\overline{}$
U
₫
^`
=
_
Ħ,
\smile
S
ℶ
3
ਨ
۲
Ō
·

18	14 15 16 17	6 8 2 9	и О И		12.0 14.0 16.0 19.0	12.0 14.0 16.0 19.0 14 15 16 17	12.0 14.0 16.0 19.0 14 15 16 17 Si P S CI	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 Ge As Se Br	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 Ge As Se Br 72.6 74.9 79.0 79.9	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35.5 Ge As Se Br 72.6 74.9 79.0 79.9 50 51 52 53	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 Ge As Se Br 72.6 74.9 79.0 79.9 50 51 52 53 Sn Sb Te I	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35.5 Ge As Se Br 72.6 74.9 79.0 79.9 50 51 52 53 Sn Sh Te I 118.7 121.8 127.6 126.9	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35.5 Ge As Se Br 72.6 74.9 79.0 79.9 50 51 52 53 Sn Sb Te I 118.7 121.8 127.6 126.9 82 83 84 85	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 Ge As Se Br 72.6 74.9 79.0 79.9 50 51 52 53 Sn Sb Te I 118.7 121.8 127.6 126.9 Pb Bi Po At	12.0 14.0 16.0 19.0 Si P S CI Si. P S CI 32 33 34 35.5 Ge As Se Br 72.6 74.9 79.0 79.0 Sn Sh Te I 118.7 121.8 127.6 126.9 Pb Bi Po At 207.2 209.0 (209) (210)	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 32 33 34 35.5 32 33 34 35.5 Ge 74.9 79.0 79.0 72.6 74.9 79.0 79.0 50 51 52 53 Sn Te I 118.7 121.8 127.6 126.9 82 83 84 85 Pb Bi Po At 207.2 209.0 (209) (210) 114 115 116 117	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl Si 31.0 32.1 35.5 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 34 35 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 50 52 52	12.0 14.0 16.0 Si P S Si P S Si SP S SI S	12.0 14.0 16.0 19.0 Si P S Cl Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 Ge As Se Br 72.6 74.9 79.0 79.9 Sn Sh Te I Rh Bi Po At Po Bi Po At 207.2 209.0 (209) (210) 114 115 116 117 FI Uup Lv Uus (289) (293) (294)	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl 28.1 31.0 32.1 35.5 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 74.9 79.0 79.0 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 50 52 52	12.0 14.0 16.0 19.0 14 15 16 17 Si P S C Si 31.0 32.1 35.5 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 33 34 35 32 34 35 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 50 51 52 60 60 70 60 70 70 70 70 70 70 70	12.0 14.0 16.0 19.0 14 15 16 17 Si P S Cl Si 31.0 32.1 35.5 32 33 34 35.5 32 33 34 35.5 32 33 34 35.5 32 33 34 35.5 32 33 34 35.5 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 53 50 51 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 52 50 52 50 52 52 50	12.0 14.0 16.0 19.0 14	12.0 14.0 16.0 19.0 19.0 14.0 15.1 14.1 15 16 17 17 15.1 1
							10.8 13	10.8 AI 27.0	10.8 13 Al 27.0 31	10.8 AI 27.0 31 Ga	10.8 Al 27.0 31 Ga 69.7	10.8 Al 27.0 31 Ga 69.7 49	10.8 13 Al 27.0 31 69.7 49	10.8 11.8 AI 27.0 31 Ga 69.7 In In	10.8 11.8 27.0 31 69.7 49 114.8 81	10.8 13 A 27.0 31 Ga 69.7 In In In 114.8 81	10.8 10.8 2.0 3.1 6.9 6.9 114.8 81 71 71	10.8 10.8 2.0 3.1 6.9 6.9 11.4.8 81 71 71 11.3	10.8 10.8 27.0 31 69.7 114.8 114.8 81 71 71 113	10.8 12.0 13 14 14 27.0 28.1 20 31 32 21 65.4 69.7 72.6 48 49 50 48 49 50 50 112.4 114.8 118.7 48 71 Pb 500.6 204.4 207.2 60 Uut FI 60 Class Class 61 Class 62 Class 63 Class 63 Class 64 Class 65 Class 65 Class 65 Class 76 Class 77 Class 78 Class 7	10.8 10.8 27.0 31 69.7 114.8 81 71 204.4 113 Uut (284)	10.8 13 Al 27.0 31 69.7 114.8 81 114.8 81 113 Uut (284)	10.8 13 Al 27.0 31 69.7 114.8 114.8 81 71 113 Uut (284) Dy	10.8 10.8 27.0 31 69.7 114.8 114.8 113 0ut 113 0ut 66 Dy	10.8 10.8 27.0 31 69.7 114.8 114.8 114.8 113 0ut 0ut 0ut 00000000000000000000000000	10.8 10.8 27.0 31 69.7 114.8 114.8 114.8 113 0ut 0ut 0ut 00000000000000000000000000
								11	11	11 29 Cu	11 29 Cu 63.5	11 29 Cu 63.5 47	11 29 Cu 63.5 47 Ag	11 29 Cu 63.5 47 Ag 107.9	11 29 Cu 63.5 47 Ag 107.9 79	11 29 Cu 63.5 47 Ag 107.9 79	11 29 Cu 63.5 47 Ag 107.9 79 Au	11 29 Cu 63.5 47 Ag 107.9 79 Au 197.0	11 29 Cu 63.5 47 Ag 107.9 Au 197.0 111	11 29 Cu 63.5 47 Ag 107.9 79 Au 197.0 111 Rg	11 29 Cu 63.5 47 47 Ag 107.9 Au 197.0 Rg	11 29 Cu 63.5 47 47 Ag 107.9 Au 197.0 111 Rg (272)	11 29 Cu 63.5 47 47 Ag 107.9 Au 197.0 111 Rg (272)	11 29 Cu 63.5 47 Ag 107.9 79 Au 111 Rg Rg (272) 64 Gd GG 157.3	11 29 Cu 63.5 47 47 Ag 107.9 79 Au 197.0 111 Rg (272) 64 Gd Gd 157.3	11 29 Cu 63.5 47 47 Ag 107.9 79 Au 197.0 111 Rg (272) 64 Gd 157.3 Cm
								-												9 10 27 28 Co Ni 58.9 58.7 45 46 Rh Pd 102.9 106.4 77 78 Ir Pt 192.2 195.1 109 110 Mt Ds (271)						
Number				(0)8/0	(2200	(200		\neg		10] <u>,</u>] ₁₀ +] ₁₀ +		10 + 10	10 = 10	10 + 10									
Ž	Symbol	•	Isotopic mass**	to one decimal p				-																		
	•,		Isot	(average t				9	6 24	6 Cr Cr	6 24 Cr 52.0	6 24 Cr 52.0 52.0 42	6 Cr 24 A2 Mo	6 Cr 24 Cr 52.0 Mo 95.9	6 Cr 24 S2.0 Mo Mo 95.9	6 Cr 24 A2 Mo 95.9 V	6 Cr 24 Cr 52.0 Mo 95.9 V 74 W 183.9	6 Cr 24 Cr 52.0 Mo 95.9 V 74 W 183.9 106	6 Cr 52.0 Mo 95.9 W 183.9 106 Sq	6 Cr S2.0 Mo 95.9 W 183.9 106 Sgg Sgg	6 Cr S2.0 A 42 Mo 95.9 W 183.9 106 Sg (263)	6 Cr 52.0 Mo 95.9 Mo 95.9 Mo 183.9 L06 Sg Sg 59	6 Cr 52.0 Mo 95.9 W 183.9 L06 Sg	6 Cr 52.0 Mo 95.9 W 183.9 106 Sg (263) Pr 140.9	6 Cr 52.0 Mo 95.9 W 183.9 L06 Sg Sg Sg Sg Pr 9140.9 Pr 9140.9	6 Cr 52.0 W 42 W 183.9 106 Sg
-					1			2	5 23	2 7	23 × × 50.9	5 23 V 50.9 41	23 × × 50.9 × 41 Nb	5 V 50.9 41 Nb	23 × × × × × × × × × × × × × × × × × × ×	5 23 × V 50.9 × 41 Nb 92.9 73 Ta	5 23 V 50.9 41 Nb 92.9 73 Ta 180.9	5 23 V V 50.9 41 Nb 92.9 73 Ta 180.9	23	23 V V S0.9 V S0.9 V S0.9 V V S0.9 V V V V V V V V V V V V V V V V V V V	23 V V S0.9 V A11 NB 92.9 TA 180.9 LB0.9 Db (262)	23	23	23	23	23
								4	4 22	4 Z I	4 22 1 1 47.9	4 22 TI 1 40 40	4 Ti 40 40 Zr	22 Ti 47.9 40 Zr 91.2	4 47.9 40 21.2 2	4 Ti Ti 47.9 40 21.2 2	22 Ti 47.9 2r 91.2 72 Hf 178.5	22 Ti 47.9 2r 91.2 72 Hf 178.5	22 Ti 47.9 2r 91.2 72 Hf 178.5 104 Rf	22 Ti 47.9 40 2r 91.2 72 Hf 178.5 104 Rf (261)	22 Ti 47.9 40 2r 91.2 72 Hf 178.5 104 Rf (261)	4 47.9 47.9 47.9 47.9 47.9 47.9 47.9 11.2 178.5 178.5 Rf (261)	22 Ti 47.9 40 2r 2r 91.2 72 Hf 178.5 104 Rf (261)	22 Ti 47.9 40 2r 40 2r 91.2 178.5 1104 Rf (261) 57 La	22 Ti 47.9 40 2r 40 2r 91.2 72 Hf 1178.5 1178.5 (261) La 138.9	22 Ti 47.9 40 2r 91.2 72 Hf 1178.5 1104 Rf (261) S7 Ha 118.9 AC
								3	3 21	3 21 Sc	3 21 Sc 45.0	3 Sc 45.0 339	Sc Sc 45.0 45.0 Y	30 45.0 45.0 4 88.9	Sc 45.0 45.0 X X X X X X X X X X	3 Sc 45.0 Y Y 88.9 Ku 71 Lu	3 Sc 45.0 39 Y Y 88.9	3 Sc 45.0 Y Y 88.9	3 Sc 45.0 Y Y 88.9 Lu 175.0 Lu 103 Lr	3 Sc 45.0 39 Y Y 88.9 Lu 175.0 103 Lr (260)	35 Sc 45.0 39 Y 88.9 71 Lu 175.0 103 Lr C(260)	35 Sc 45.0 45.0 71 103 103 Lr (260)	3 Sc 45.0 45.0 71 Lu 175.0 103 Lr (260)	3 Sc 45.0	3 Sc 45.0	21 Sc 45.0 45.0 71 71 103 103 103
	2	4	Be	9.0	12	Mg		24.3	24.3	24.3 Ca	24.3 Ca 40.1	24.3 Ca 40.1	24.3 Ca 40.1 38	24.3 Ca Ca 40.1 38 Sr 87.6	20 Ca Ca 40.1 38 Sr 87.6 56	24.3 Ca 20 Ca 40.1 38 Sr 87.6 Ba 86	24.3 20 Ca Ca 40.1 38 Sr.6 87.6 Ba Ba	24.3 24.3 24.3 20 Ca	24.3 20 20 Ca	24.3 Ca Ca 40.1 38 S7.6 Ba Ba 137.3 Ra Ra Ra	24.3 20 20 Ca 40.1 38 Sr 87.6 Ba 137.3 Ra Ra 226.0	24.3 20 20 Ca 40.1 38 87.6 Ba 137.3 88 Ra 226.0	24.3 20 Ca 40.1 38 87.6 Ba 137.3 88 Ra Ra 226.0	24.3 20 Ca 40.1 38 S7 87.6 Ba 137.3 88 Ra 226.0	24.3 Ca Ca Ca 38 Sr S7.6 Ba Ba 137.3 Ra Ra 226.0	24.3 20 Ca Ca 38 87.6 87.6 88 Ra 226.0
-	1 .0	က	=	6.9	11	R		23.0	19	23.0 19	19 K 39.1	19 K 39.1 37	25.0 19 K 39.1 37 Rb	23.0 K K 39.1 37 Rb 85.5	23.0 K 39.1 37 Rb 85.5 55	23.0 K 37 Rb 85.5 Cs	23.0 K 39.1 37 Rb 85.5 55 CS CS	23.0 K 39.1 37 Rb 85.5 GS CS 132.9 87 87 87 87 87 88 87 87	25.0 19 K 39.1 37 Rb 85.5 55 CS 132.9 Rb 85.5 Fr	25.0 19 K 39.1 37 Rb 85.5 55 Cs 132.9 87 87 Fr	25.0 19 K 39.1 37 85.5 55 CS 132.9 87 Fr	25.0 19 K 39.1 37 Rb 85.5 55 Cs 132.9 87 Fr	25.0 19 K 39.1 37 Rb 85.5 55 CS 132.9 87 Fr	25.0 19 K 39.1 37 Rb 85.5 Cs 132.9 87 87 87	25.0 19 K 39.1 37 Rb 85.5 Cs 65 67 87 87 87 87 87 87 87 87 87 8	25.0 19 K 39.1 37 Rb 85.5 55 Cs 87 87 87 87 87 87 87 87 87 87

Groups are in accordance with IUPAC nomenclature.
 ** Values in brackets are for the isotope with the longest half-life.

List of elements by name

Name	No.	Symbol	Name	No.	Symbol	Name	No.	Symbol	Name	No.	Symbol
Hydrogen	_	エ	Selenium	34	Se	Holmium	29	Но	Fermium	100	Fm
Helium	2	He	Bromine	35	Br	Erbium	68	Er	Mendelevium	101	Md
Lithium	3	Li	Krypton	36	Kr	Thulium	69	Tm	Nobelium	102	No
Beryllium	4	Be	Rubidium	37	Rb	Ytterbium	70	Yb	Lawrencium	103	Lr
Boron	2	В	Strontium	38	Sr	Lutetium	71	Lu	Rutherfordium	104	Rf
Carbon	9	2	Yttrium	39	Å	Hafnium	72	Hf	Dubnium	105	Db
Nitrogen	7	Z	Zirconium	40	JΖ	Tantalum	73	Та	Seaborgium	106	Sg
Oxygen	8	0	Niobium	41	qN	Tungsten	74	W	Bohrium	107	Bh
Fluorine	6	F	Molybdenum	42	Мо	Rhenium	75	Re	Hassium	108	Hs
Neon	10	Ne	Technetium	43	Tc	Osmium	92	Os	Meitnerium	109	Mt
Sodium	11	Na	Ruthenium	44	Ru	Iridium	77	lr	Darmstadtium	110	Ds
Magnesium	12	Mg	Rhodium	45	Rh	Platinum	78	Pt	Roentgenium	111	Rg
Aluminum	13	Al	Palladium	46	рd	Gold	62	Au	Copernicium	112	Cn
Silicon	4	Si	Silver	47	Ag	Mercury	80	Hg	Ununtrium	113	Uut
Phosphorus	15	Ь	Cadmium	48	рЭ	Thallium	81	TI	Flerovium	114	FI
Sulfur	16	S	Indium	49	ul	Lead	82	Pb	Ununpentium	115	Oup
Chlorine	17	Cl	Tin	20	Sn	Bismuth	83	Bi	Livermorium	116	Lv
Argon	18	Ar	Antimony	51	qs	Polonium	84	Ро	Ununseptium	117	Ous
Potassium	19	K	Tellurium	52	Те	Astatine	85	At	Ununoctium	118	Ono
Calcium	20	Ca	lodine	53	l	Radon	98	Rn			
Scandium	21	Sc	Xenon	54	Xe	Francium	87	Fr			
Titanium	22	Τi	Cesium	22	Cs	Radium	88	Ra			
Vanadium	23	^	Barium	99	Ba	Actinium	89	Ac			
Chromium	24	Cr	Lanthanum	22	La	Thorium	90	Th			
Manganese	25	Mn	Cerium	28	Ce	Protactinium	91	Ра			
Iron	26	Fe	Praseodymium	29	Pr	Uranium	92	U			
Cobalt	27	Co	Neodymium	09	Nd	Neptunium	93	Np			
Nickel	28	Ϊ́	Promethium	61	Pm	Plutonium	94	Pu			
Copper	29	Cu	Samarium	62	Sm	Americium	95	Am			
Zinc	30	Zn	Europium	63	Eu	Curium	96	Cm			
Gallium	31	Ga	Gadolinium	64	Gd	Berkelium	97	BĶ			
Germanium	32	Ge	Terbium	65	Tb	Californium	98	Cf			
Arsenic	33	As	Dysprosium	99	Dy	Einsteinium	66	Es			

© The State of Queensland (Queensland Curriculum and Assessment Authority) 2014

Copyright protects this material. Copyright in the Senior External Examination is owned by the State of Queensland and/or the Queensland Curriculum and Assessment Authority. Copyright in some of the material included in the paper is owned by third parties.

Except as permitted by the *Copyright Act 1968* (Cwlth), reproduction by any means (photocopying, electronic, mechanical, recording or otherwise), making available online, electronic transmission or other publication of this material is prohibited without prior written permission of the relevant copyright owner/s.

The Queensland Curriculum and Assessment Authority requires to be recognised as the source of the Senior External Examination and requires that its material remain unaltered.

Enquiries relating to copyright in this material, which is owned by the State of Queensland or the Queensland Curriculum and Assessment Authority, should be addressed to:

Manager Publishing Unit Email: publishing@qcaa.qld.edu.au

Queensland Curriculum & Assessment Authority

PO Box 307, Spring Hill QLD 4004 Australia Level 7, 154 Melbourne Street, South Brisbane T + 61 7 3864 0299 F + 61 7 3221 2553

www.qcaa.qld.edu.au