

# 2014 Senior External Examination

## Physics

### Paper One — Resource book

Monday 10 November 2014

9 am to 11:40 am

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#### 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

$v_{av} = \frac{s}{t}$	$n_1 v_1 = n_2 v_2$
$a_{av} = \frac{\Delta v}{t}$	$v = f\lambda$
$v = u + at$	$E = \frac{kq}{d^2}$
$s = \frac{1}{2} (u + v) t$	$F = \frac{kq_1 q_2}{d^2}$
$s = ut + \frac{1}{2} at^2$	$E = \frac{F}{q}$
$v^2 = u^2 + 2as$	$V = Ed$
$F = ma$	$q = It$
$a_c = \frac{v^2}{r}$	$V = IR$
$F = \frac{Gm_1 m_2}{r^2}$	$P = VI$
$P = \frac{W}{t}$	$W = VIt$
$KE = \frac{1}{2} mv^2$	$R = R_1 + R_2 + \dots$
$PE = \frac{1}{2} kx^2$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
$PE = mgh$	$\beta = \frac{I_C}{I_B}$
$ F  =  kx $	$F = BIL \sin \theta$
$W = Fs \cos \theta$	$F = Bqv \sin \theta$
$p = mv = F\Delta t$	$B = \frac{KI}{r}$
$d \sin \theta = \frac{dx_n}{L} = n\lambda$	$B = 2\pi KIN$ (N = no. of turns per unit length)
$d \sin \theta = \frac{dx_n}{L} = \left(n - \frac{1}{2}\right)\lambda$	$\phi = BA \cos \theta$
$\frac{V_p}{V_s} = \frac{I_s}{I_p} = \frac{N_p}{N_s}$	$\mathcal{E} = \frac{-\Delta \phi}{\Delta t}$
$\sin \theta_c = \frac{n_2}{n_1}$	$\mathcal{E} = BLv$
$\Delta x = \frac{L\lambda}{d}$	$E = hf$
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	$KE = hf - W$

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## Physical constants

Acceleration due to gravity (g)	=	$9.80 \text{ ms}^{-2}$
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 eV	=	$1.60 \times 10^{-19} \text{ J}$
Mass of electron	=	$9.11 \times 10^{-31} \text{ kg}$
Charge on electron	=	$-1.60 \times 10^{-19} \text{ C}$

Periodic Table of Elements																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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H	1.0	Li	6.9	Be	9.0	11	Na	23.0	12	Mg	24.3	13	Al	27.0	14	Si	28.1	15	P	31.0	16	S	32.1	17	Cl	35.5	18	Ar	39.9	19	K	39.1	20	Ca	40.1	21	Sc	45.0	22	Ti	47.9	23	V	50.9	24	Cr	52.0	25	Mn	54.9	26	Fe	55.8	27	Co	58.9	28	Ni	58.7	29	Cu	63.5	30	Zn	65.4	31	Ga	69.7	32	Ge	72.6	33	As	74.9	34	Se	79.0	35	Br	79.9	36	Kr	83.8	37	Rb	85.5	38	Sr	87.6	39	Y	88.9	40	Zr	91.2	41	Nb	92.9	42	Mo	95.9	43	Tc	(98)	44	Ru	101.1	45	Rh	102.9	46	Pd	106.4	47	Ag	107.9	48	Cd	112.4	49	In	114.8	50	Sn	118.7	51	Sb	121.8	52	Te	127.6	53	I	126.9	54	Xe	131.3	55	Cs	132.9	56	Ba	137.3	57	La	138.9	58	Ce	140.9	59	Pr	140.9	60	Nd	144.2	61	Pm	(145)	62	Sm	150.4	63	Eu	152.0	64	Gd	157.3	65	Tb	158.9	66	Dy	162.5	67	Ho	164.9	68	Er	167.3	69	Tm	168.9	70	Yb	173.0	71	Lu	174.9	72	Hf	178.5	73	Ta	180.9	74	W	183.9	75	Re	186.2	76	Os	190.2	77	Ir	192.2	78	Pt	195.1	79	Au	197.0	80	Hg	200.6	81	Tl	204.4	82	Pb	207.2	83	Bi	209.0	84	Po	(209)	85	At	(210)	86	Rn	(222)	87	Fr	(223)	88	Ra	(226)	89	Ac	(227)	90	Th	232.0	91	Pa	(231)	92	U	238.0	93	Np	(237)	94	Pu	(244)	95	Am	(243)	96	Cm	(247)	97	Bk	(247)	98	Cf	(251)	99	Es	(252)	100	Fm	(257)	101	Md	(258)	102	No	(259)	103	Lr	(260)	104	Rf	(261)	105	Db	(262)	106	Sg	(263)	107	Bh	(264)	108	Hs	(269)	109	Mt	(268)	110	Ds	(271)	111	Rg	(272)	112	Cn	(285)	113	Uut	(284)	114	Fl	(289)	115	Uup	(288)	116	Lv	(293)	117	Uus	(294)	118	Uuo	(294)	119	Uuq	(295)	120	Uub	(296)	121	Uut	(297)	122	Uuq	(298)	123	Uub	(299)	124	Uut	(300)	125	Uuq	(301)	126	Uub	(302)	127	Uut	(303)	128	Uuq	(304)	129	Uub	(305)	130	Uut	(306)	131	Uuq	(307)	132	Uub	(308)	133	Uut	(309)	134	Uuq	(310)	135	Uub	(311)	136	Uut	(312)	137	Uuq	(313)	138	Uub	(314)	139	Uut	(315)	140	Uuq	(316)	141	Uub	(317)	142	Uut	(318)	143	Uuq	(319)	144	Uub	(320)	145	Uut	(321)	146	Uuq	(322)	147	Uub	(323)	148	Uut	(324)	149	Uuq	(325)	150	Uub	(326)	151	Uut	(327)	152	Uuq	(328)	153	Uub	(329)	154	Uut	(330)	155	Uuq	(331)	156	Uub	(332)	157	Uut	(333)	158	Uuq	(334)	159	Uub	(335)	160	Uut	(336)	161	Uuq	(337)	162	Uub	(338)	163	Uut	(339)	164	Uuq	(340)	165	Uub	(341)	166	Uut	(342)	167	Uuq	(343)	168	Uub	(344)	169	Uut	(345)	170	Uuq	(346)	171	Uub	(347)	172	Uut	(348)	173	Uuq	(349)	174	Uub	(350)	175	Uut	(351)	176	Uuq	(352)	177	Uub	(353)	178

\* 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	Name	No.	Symbol
Hydrogen	1	H	Selenium	34	Se	Holmium	67	Ho	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	5	B	Strontium	38	Sr	Lutetium	71	Lu	Rutherfordium	104	Rf			
Carbon	6	C	Yttrium	39	Y	Hafnium	72	Hf	Dubnium	105	Db			
Nitrogen	7	N	Zirconium	40	Zr	Tantalum	73	Ta	Seaborgium	106	Sg			
Oxygen	8	O	Niobium	41	Nb	Tungsten	74	W	Bohrium	107	Bh			
Fluorine	9	F	Molybdenum	42	Mo	Rhenium	75	Re	Hassium	108	Hs			
Neon	10	Ne	Technetium	43	Tc	Osmium	76	Os	Meitnerium	109	Mt			
Sodium	11	Na	Ruthenium	44	Ru	Iridium	77	Ir	Darmstadtium	110	Ds			
Magnesium	12	Mg	Rhodium	45	Rh	Platinum	78	Pt	Roentgenium	111	Rg			
Aluminium	13	Al	Palladium	46	Pd	Gold	79	Au	Copernicium	112	Cn			
Silicon	14	Si	Silver	47	Ag	Mercury	80	Hg	Ununtrium	113	Uut			
Phosphorus	15	P	Cadmium	48	Cd	Thallium	81	Tl	Flerovium	114	Fl			
Sulfur	16	S	Indium	49	In	Lead	82	Pb	Ununpentium	115	Uup			
Chlorine	17	Cl	Tin	50	Sn	Bismuth	83	Bi	Livermorium	116	Lv			
Argon	18	Ar	Antimony	51	Sb	Polonium	84	Po	Ununseptium	117	Uus			
Potassium	19	K	Tellurium	52	Te	Astatine	85	At	Ununoctium	118	Uuo			
Calcium	20	Ca	Iodine	53	I	Radon	86	Rn						
Scandium	21	Sc	Xenon	54	Xe	Francium	87	Fr						
Titanium	22	Ti	Cesium	55	Cs	Radium	88	Ra						
Vanadium	23	V	Barium	56	Ba	Actinium	89	Ac						
Chromium	24	Cr	Lanthanum	57	La	Thorium	90	Th						
Manganese	25	Mn	Cerium	58	Ce	Protactinium	91	Pa						
Iron	26	Fe	Praseodymium	59	Pr	Uranium	92	U						
Cobalt	27	Co	Neodymium	60	Nd	Neptunium	93	Np						
Nickel	28	Ni	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	Bk						
Germanium	32	Ge	Terbium	65	Tb	Californium	98	Cf						
Arsenic	33	As	Dysprosium	66	Dy	Einsteinium	99	Es						

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