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

After the examination session

Take this book when you leave.

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Planning space

Formulas

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

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Physical constants

Acceleration due to gravity (g)	=	$9.80\ ms^{-2}$
Universal gravitational constant (G)	=	$6.67 \times 10^{-11}\ Nm^2kg^{-2}$
Speed of light (c)	=	$3.00 \times 10^{8}\ ms^{-1}$
Refractive index of air	=	1.00
Radius of Earth	=	6.38×10^{6} m
Earth–Moon separation	=	3.85×10^{5} km
Earth–Sun separation	=	1.50×10^{8} km
Mass of Earth	=	5.98×10^{24} kg
Mass of Moon	=	7.35×10^{22} kg
Mass of Sun	=	1.99×10^{30} kg
Ampère's constant (K)	=	$2.00 \times 10^{-7}\ NA^{-2}$
Coulomb's constant (k)	=	$9.00 \times 10^{9}\ Nm^2C^{-2}$
Planck's constant (h)	=	6.63×10^{-34} Js
Mass of proton	=	1.67×10^{-27} kg
Mass of neutron	=	1.68×10^{-27} kg
1 eV	=	1.60×10^{-19} J
Mass of electron	=	9.11×10^{-31} kg
Charge on electron	=	-1.60×10^{-19} C

Periodic table

Groups (IUPAC)*

1												13	14	15	16	17	18
1 **H** 1.0	2																**2** **He** 4.0
3 **Li** 6.9	**4** **Be** 9.0											**5** **B** 10.8	**6** **C** 12.0	**7** **N** 14.0	**8** **O** 16.0	**9** **F** 19.0	**10** **Ne** 20.2
11 **Na** 23.0	**12** **Mg** 24.3	3	4	5	6	7	8	9	10	11	12	**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	**71** **Lu** 175.0	**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** 226.0	**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)

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
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)

Atomic Number

Symbol

Isotopic mass**
(average to one decimal place)

*** 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	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
Aluminum	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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