UNIVERSITI SAINS MALAYSIA

Final Examination
2016/2017 Academic Session

May/June 2017

JIF 104 – Physics II/ Practical Ib
[JIF 104 – Fizik II/Amali Ib]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper has **NINE** printed pages before you answer any questions.

Answer **FIVE** questions. You may answer **either** in Bahasa Malaysia or in English.

In the event of any discrepancies, the English version shall be used.

Read the instructions carefully before answering.

Each question carries 100 marks.

*Sila pastikan kertas peperiksaan ini mengandungi **SEMBILAN** muka surat yang bercetak sebelum anda menjawab sebarang soalan.*

*Jawab **LIMA** soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris.*

Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

Baca setiap arahan dengan teliti sebelum menjawab.

Setiap soalan bernilai 100 markah.

Constants:

Gravitational acceleration $g = 9.8$ m s^{-2}

Density of water = 1000 kg m^{-3}

1 Pa = 1 N m^{-2}

1 atm = 1.013×10^{5} Pa

Molar gas constant $R = 8.31$ J mol^{-1} K^{-1}

Boltzmann's constant $k = 1.38 \times 10^{-23}$ J K^{-1}

Boltzmann's constant $k = 8.6 \times 10^{-5}$ eV K^{-1}

Avogadro's number = 6.022×10^{23} mol^{-1}

1 poise = 10^{-1} N s m^{-2}

Density of mercury = 13.6 g cm^{-3}

Mass of hydrogen atom = 1.67×10^{-27} kg

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1. (a) With appropriate diagram, discuss the

   (i) Bohr atomic model

   (ii) wave-mechanical atomic model.

   (30 marks)

   (b) Briefly explain the differences between ionic, covalent and metallic bonding.

   (30 marks)

   (c) Explain why covalently bonded materials are generally less dense than ionically or metallically bonded ones.

   (20 marks)

   (d) Write the electron configurations of the following ions:

   (i) Fe^{2+}

   (ii) Al^{3+}

   (20 marks)

2. (a) Explain the fundamental concepts:

   (i) Crystalline

   (ii) Lattice

   (20 marks)

   (b) Calculate the fraction of atom sites that are vacant for lead at its melting temperature of 327°C (600 K). Assume an activation energy of 0.55 eV/atom.

   (20 marks)

(c) Iridium has a FCC crystal structure. When 0.154 nm X-ray is used, the first order angle of diffraction for the (220) set of planes occurs at 69.20°.

(i) Sketch the crystal structure of iridium.

(10 marks)

(ii) Calculate the interplanar spacing for these set of planes.

(20 marks)

(iii) Calculate the atomic radius for an iridium atom.

(30 marks)

3. (a) With the aid of a diagram, define as following:

(i) Point defect.

(ii) Line defect.

(iii) Area defect.

(30 marks)

(b) With the aid of a diagram, explain the difference between edge dislocation and screw dislocation.

(30 marks)

(c) Calculate the activation energy for vacancy formation in aluminum, given that the equilibrium number of vacancies at 500°C (773 K) is 7.55×10^{23} m^{-3}. The atomic weight and density at 500°C for aluminum are 26.98 g/mol and 2.62 g/cm^3 respectively.

(40 marks)

4. (a) Define

(i) surface tension.

(ii) free surface energy.

(20 marks)

(b) Explain the relationship between free surface energy and temperature.

(30 marks)

(c) Explain why it is easier to move a molecule from the interior of the liquid to the surface when the temperature of the liquid is higher.

(20 marks)

(d) A capillary tube is immersed in water with its lower end 10 cm below the surface of the water. Water rises in the tube to a height of 4 cm above the water level outside the tube and the angle of contact is zero. Determine the gauge pressure needed to be blown into the tube so that the water level inside the tube is at the same level as the water surface outside the tube.

(30 marks)

5. (a) State the differences between a laminar flow and a turbulent flow

(40 marks)

(b) Determine the relationship between the Euler's equation and the Bernoulli's equation.

(10 marks)

(c) Determine the mass of oxygen contained in a container of volume 2 m^3, pressure 104 Nm^{-2} and temperature 7 °C.

(30 marks)

(d) Using an appropriate graph, explain the effect of temperature on the distribution of gas molecule speeds.

(20 marks)

1. (a) *Dengan menggunakan gambar rajah yang bersesuaian, bincangkan*

(i) model atom Bohr.

(ii) model atom gelombang-mekanikal.

(30 markah)

(b) *Terangkan secara ringkas perbezaan antara ikatan ionik, kovalen dan logam.*

(30 markah)

(c) *Terangkan mengapa secara umumnya bahan kovalen terikat kurang padat daripada yang ionik atau logam terikat.*

(20 markah)

(d) *Tulis konfigurasi elektron bagi ion-ion berikut:*

(i) Fe^{2+}

(ii) Al^{3+}

(20 markah)

2. (a) *Terangkan konsep asas bagi*

(i) habluran.

(ii) kekisi.

(20 markah)

(b) *Kirakan pecahan untuk bahagian atom yang kosong bagi plumbum pada suhu lebur 327°C (600 K). Andaikan tenaga pengaktifan bersamaan 0.55 eV/atom.*

(20 markah)

(c) *Iridium mempunyai struktur hablur FCC. Apabila sinar-X dengan panjang gelombang 0.154 nm digunakan, sudut belauan peringkat pertama bagi set satah (220) berlaku pada 69.20°.*

(i) Lakar struktur hablur iridium.

(10 markah)

(ii) Hitung jarak antara satah bagi set satah tersebut.

(20 markah)

(iii) Hitung jejari atom bagi satu atom iridium.

(30 markah)

3. (a) *Dengan bantuan gambar rajah, takrif*

(i) kecacatan titik

(ii) kecacatan garisan

(iii) kecacatan kawasan

(30 markah)

(b) *Dengan bantuan gambar rajah, terangkan perbezaan antara kehelan pinggir dan kehelan skru.*

(30 markah)

(c) *Kira tenaga pengaktifan untuk pembentukan kekosongan dalam aluminium, diberi jumlah keseimbangan kekosongan pada 500 ° C (773 K) adalah* $7.55 \times 10^{23}\ m^{-3}$. *Berat atom dan ketumpatan pada 500 ° C untuk aluminium ialah masing-masing 26.98 g / mol dan* $2.62\ g / cm^3$.

(40 markah)

4. (a) *Takrif*

(i) ketegangan permukaan.

(ii) tenaga permukaan bebas.

(20 markah)

(b) *Terangkan hubungan antara tenaga permukaan bebas dan suhu.*

(30 markah)

(c) *Jelaskan mengapa lebih mudah untuk menggerakkan molekul dari bahagian dalam cecair ke permukaan apabila suhu cecair lebih tinggi.*

(20 markah)

(d) *Suatu tiub rerambut dicelupkan dalam air dengan hujung bawahnya 10 cm di bawah permukaan air. Air di dalam tiub naik ke ketinggian 4 cm di atas paras air di luar tiub dan sudut sentuh adalah sifar. Tentukan tekanan tolok yang perlu ditiup ke dalam tiub agar paras air dalam tiub sama paras dengan permukaan air di luar tiub.*

(30 markah)

5. (a) *Nyatakan perbezaan antara aliran lamina dan aliran gelora.*

(40 markah)

(b) *Tentukan hubungan antara persamaan Euler dan persamaan Bernoulli.*

(10 markah)

(c) *Tentukan jisim oksigen yang terkandung di dalam bekas dengan isipadu 2* m^3*, tekanan 104* Nm^{-2} *dan suhu 7 ° C.*

(30 markah)

(d) *Dengan menggunakan graf yang bersesuaian, terangkan kesan suhu ke atas taburan kelajuan molekul gas.*

(20 markah)

IUPAC Periodic Table of the Elements

1																	18
1 **H** hydrogen [1.007, 1.009]	2		Key: atomic number **Symbol** name standard atomic weight									13	14	15	16	17	2 **He** helium 4.003
3 **Li** lithium [6.938, 6.997]	4 **Be** beryllium 9.012											5 **B** boron [10.80, 10.83]	6 **C** carbon [12.00, 12.02]	7 **N** nitrogen [14.00, 14.01]	8 **O** oxygen [15.99, 16.00]	9 **F** fluorine 19.00	10 **Ne** neon 20.18
11 **Na** sodium 22.99	12 **Mg** magnesium [24.30, 24.31]	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 26.98	14 **Si** silicon [28.08, 28.09]	15 **P** phosphorus 30.97	16 **S** sulfur [32.05, 32.08]	17 **Cl** chlorine [35.44, 35.46]	18 **Ar** argon 39.95
19 **K** potassium 39.10	20 **Ca** calcium 40.08	21 **Sc** scandium 44.96	22 **Ti** titanium 47.87	23 **V** vanadium 50.94	24 **Cr** chromium 52.00	25 **Mn** manganese 54.94	26 **Fe** iron 55.85	27 **Co** cobalt 58.93	28 **Ni** nickel 58.69	29 **Cu** copper 63.55	30 **Zn** zinc 65.38(2)	31 **Ga** gallium 69.72	32 **Ge** germanium 72.63	33 **As** arsenic 74.92	34 **Se** selenium 78.97	35 **Br** bromine [79.90, 79.91]	36 **Kr** krypton 83.80
37 **Rb** rubidium 85.47	38 **Sr** strontium 87.62	39 **Y** yttrium 88.91	40 **Zr** zirconium 91.22	41 **Nb** niobium 92.91	42 **Mo** molybdenum 95.95	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	57-71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium [204.3, 204.4]	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	89-103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium	113 **Uut** ununtrium	114 **Fl** flerovium	115 **Uup** ununpentium	116 **Lv** livermorium	117 **Uus** ununseptium	118 **Uuo** ununoctium

57 **La** lanthanum 138.9	58 **Ce** cerium 140.1	59 **Pr** praseodymium 140.9	60 **Nd** neodymium 144.2	61 **Pm** promethium	62 **Sm** samarium 150.4	63 **Eu** europium 152.0	64 **Gd** gadolinium 157.3	65 **Tb** terbium 158.9	66 **Dy** dysprosium 162.5	67 **Ho** holmium 164.9	68 **Er** erbium 167.3	69 **Tm** thulium 168.9	70 **Yb** ytterbium 173.0	71 **Lu** lutetium 175.0
89 **Ac** actinium	90 **Th** thorium 232.0	91 **Pa** protactinium 231.0	92 **U** uranium 238.0	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium

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For notes and updates to this table, see www.iupac.org. This version is dated 8 January 2016.