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IGCSE / GCSE / IB MYP / KS3 / MO / F.1 - F.6 / Y9 - Y13

2014 HKDSE PHYSICS Paper 1A

Suggested Solutions

Prepared by Andy Lai

HKDSE 5** Physics Teacher

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2014 HKDSE Physics Paper IA Suggested Answers

1.	D	2.	A	3.	C	4.	A	5.	B
6.	D	7.	C	8.	C	9.	B	10.	B
11.	B	12.	B	13.	B	14.	A	15.	C
16.	A	17.	B	18.	C	19.	A	20.	C
21.	D	22.	D	23.	B	24.	C	25.	D
26.	A	27.	D	28.	D	29.	B	30.	B
31.	D	32.	A	33.	C				

Section A

1. D

黎 Sir 提提你 :

1. **Vacuum flask: reduce the rate of heat transfer by conduction and convection.**

2. **The temperature of ice-cream < temperature of surroundings**

⇒ Heat transfer from the surroundings to the ice-cream

⇒ Heat gain by ice-cream from surroundings

3. **Therefore, the rate of heat gains from surroundings is slower for the ice-cream inside the vacuum than that insider a paper cup.**

⇒ The time taken to melt the ice-cream completely inside the vacuum flask is longer than that inside the paper cup.

2. A

黎 Sir 提提你 :

1. **Define the symbols as follows:**

- **P: Power of the heater**
- **t: time taken for the change of temperature**
- **m: mass of the solid substance X**
- **c: specific heat capacity of the solid substance X**
- **ΔT : Change in temperature**
- **l: specific latent heat of fusion of the solid substance X**

2. **By** $Pt = mc(\Delta T)$

$P(2\times 60) = m(800)(80-20)$

$P = 400m$

3. **By** $Pt = ml$

$400m(8-2)(60) = ml$

l = 144 kJ kg^{-1}

3.	**C**	**黎 Sir 提提你 :** **1. Uniform density $\Rightarrow$ Center of mass is located in the middle of the rod!** **2. Two different materials $\Rightarrow$ Two center of mass!** **3. Taking moment at Q:** $m_{PQ}g(2) = m_{QR}g(3) \Rightarrow \frac{m_{PQ}}{m_{QR}} = \frac{3}{2} \Rightarrow m_{PQ} : m_{QR} = 3:2$ **!**

4.	**A**	**黎 Sir 提提你 :** **1. Tension of the left string = 30 N** **2. Tension of the right string = 20 N** **3. Resolving Tension of the left string and that of the right string into horizontal and vertical components respectively gives:** $\begin{cases} Vertical\ direction: 30\sin\theta + 20\sin\phi = W \\ Horizontal\ direction: 30\cos\theta = 20\sin\phi \end{cases}$ **4.** $\because$ θ and ϕ are less than 90° $\Rightarrow$ Both $\sin\theta$ and $\sin\phi$ < 1 **5.** Therefore, W < 30(1) + 20(1) = 50 N!

5. **B**

黎 Sir 提提你 :

1. **In the 1st phase, let u = u, v = v, a = a, s = 36, t = 4,**

   By $S = \frac{(u+v)t}{2}$ $\Rightarrow$ **36 = (u + v)(4)/2** $\Rightarrow$ **u + v = 18 … (1)**

2. **In the 2nd phase, let u = v, v = w, a = a, s = 36, t = 2**

   By $S = \frac{(u+v)t}{2}$ $\Rightarrow$ **36 = (v + w)(2)/2** $\Rightarrow$ **v + w = 36 … (2)**

3. **By (2) – (1) gives: w – u = 18**

4. **By** $a = \frac{(v+u)}{t} \Rightarrow a = \frac{(w-u)}{t} \Rightarrow a = \frac{18}{4+2} \Rightarrow a = 3\ m\ s^{-2}$

6. **D**

黎 Sir 提提你 :

1. **By law of conversation of energy** $\Rightarrow$ **Loss in G.P.E. = Gain in K.E.**

   $$mgH = \frac{1}{2}mv^2$$

   $$v = \sqrt{2gH}$$

2. **Therefore, Same height** $\Rightarrow$ **Same velocity!**

3. **Consider the downward component of weight and by Newton's 2nd law:**

   $mg\sin\theta = ma \Rightarrow a = g\sin\theta$

4. **Since** $\uparrow\theta \Rightarrow \uparrow\sin\theta \Rightarrow \uparrow a \Rightarrow \downarrow t$!

5. **Therefore,** $t_2 > t_1$!

7.	**C**	**黎 Sir 提提你 :** **1. The force on ball Q by ball P is to the right ⇒ Ball Q can only move to the right and so the ball P since both of ball P and Q moves in the same direction after collision.** **2. Take the right direction as positive, by Law of conservation of momentum,** • **Option 1: (2)(+6) + 1(0) = 2(v) + 1(+2) ⇒ v = +6 m s^{-1} > + 2 m s^{-1}** **⇒ Not possible since both P and Q move in the same direction after collision but the speed of P cannot be faster than that of Q!** • **Option 2: (2)(+6) + 1(0) = 2(v) + 1(+4) ⇒ v = +3 m s^{-1} < + 4 m s^{-1}** **⇒ Possible since both P and Q move in the same direction after collision and the speed of P should be slower than or equal to that of Q!** • **Option 1: (2)(+6) + 1(0) = 2(v) + 1(+6) ⇒ v = +2 m s^{-1} < + 6 m s^{-1}** **⇒ Possible since both P and Q move in the same direction after collision and the speed of P should be slower than or equal to that of Q!**

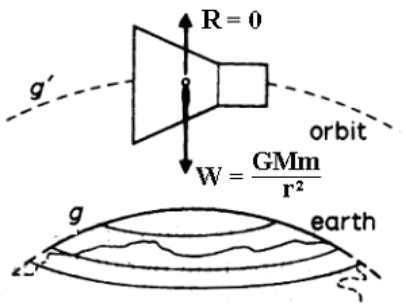
8.	**C**	**黎 Sir 提提你 :** **1. By Newton's second law and two block as a single system:** **5g – 3g = 8a ⇒ a = ¼ g**

9.	**B**	**黎 Sir 提提你 :** **1. Taking downward as negative!** **2. Given u = -2, v = -11, s = ?, a = -9.81, t = ?** **3. By $v^2 - u^2 = 2as$ ⇒ $121 - 4 = 2(-9.81)s$ ⇒ s = -5.96 = - 6 m**

10.	**B**	**黎 Sir 提提你 :** **1. Take downward as negative,** **2. Consider vertical motion: u = 0, v = ?, a = -9.81, s = -0.8, t = ?** **3. By** $s = ut + \frac{1}{2}at^2 \Rightarrow -0.8 = \frac{1}{2}(-9.81)t^2 \Rightarrow t = 0.401$ **s** **4. Consider horizontal motion: u = s/t ⇒ u = 1/0.401 = 2.5 m s^{-1}**

11. B

黎 Sir 提提你 :



1. **Weightless ≠ Losing all weights!**

2. **Weightless = Reading of the scale = 0 N, i.e. Normal Reaction = 0 N.**

3. **The astronaut inside a spacecraft is performing circular motion. The centripetal force is completely provided by his weight.**

4. **Moreover, the astronaut and the spacecraft are both moving with the same acceleration towards the Earth!**

5. **Therefore, the normal reaction from the floor of the spacecraft is zero. and thus, the astronaut feels weightlessness.**

6. **To prove R = 0 N, consider the free body diagram of the astronaut:**

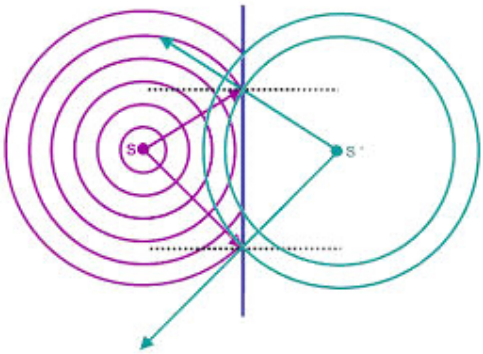
$$\frac{GMm}{r^2} - R = \frac{mv^2}{r}$$

But $v = \sqrt{\frac{GM}{r}}$ **which is the orbital speed of the satellite.**

$$\therefore \frac{GMm}{r^2} - R = \frac{m\frac{GM}{r}}{r}$$

$$R = 0$$

7. **Therefore, Normal Reaction = 0 N! ⇒ Weightless occur!**

12.	B	黎 Sir 提提你 : 1. By $g = GM/R^2$ where R: radius of the Earth, M: Mass of the Earth, G: Gravitational constant, g: acceleration due to gravity on the Earth surface. 2. By $a = \frac{v^2}{r} \Rightarrow a = \frac{(\sqrt{\frac{GM}{2R}})^2}{2R} \Rightarrow a = \frac{GM}{4R^2} \Rightarrow a = \frac{1}{4}g$.
13.	B	黎 Sir 提提你 : 1. Please refer to the diagram below: 
14.	A	黎 Sir 提提你 : 1. Draw the next moment of the wave and you will find P is moving upwards and Q, R, and S are moving downwards. 2. The particles apart from exactly one wavelength are in-phase during transformation while the particle apart from half wavelength are exactly out-of-phase of antiphase. 3. Only particle located at glucose can survive.

15.	**C**	**黎 Sir 提提你 :** **1. By** $\frac{\sin\theta_1}{\sin\theta_2}=\frac{v_1}{v_2}=\frac{\lambda_1}{\lambda_2}=\frac{n_2}{n_1} \Rightarrow \uparrow\theta \Rightarrow \uparrow v$ **!** **2. Therefore,** $v_{III} < v_I < v_{II}$
16.	**A**	**黎 Sir 提提你 :** **1. ↑ wavelength or ↓ gap size ⇒ ↑ Degree of diffraction!** **2. Amplitude is nothing to do with diffraction!**
17.	**B**	**黎 Sir 提提你 :** **1. By speed = distance / time** $\Rightarrow 340=\frac{64+x+x+64}{0.5-0.1} \Rightarrow$ x = 4 m **2. Therefore,** $v = 4/[(0.5-0.1)/2] = 20\ m\ s^{-1}$
18.	**C**	**黎 Sir 提提你 :** **1. Two sources of sound waves are anti-phase,** ● **Constructive Interference if Path difference = $PS_1 - PS_2 = n+\frac{1}{2}\lambda$, n = 0, 1,..** ● **Destructive Interference, Path difference = $PS_1 - PS_2 = n\lambda$, n=0,1,2,..** **2. The path difference at O =** 0λ **⇒ Destructive interference** **3. The path difference at P = (3 – 2.8) / 0.2 =** 2λ **⇒ Destructive interference!**

19.	A	黎 Sir 提提你 : 1. Sound waves are mechanical wave, not EM wave. 2. Sound waves travel vaccum.

20.	C	黎 Sir 提提你 : 1. Holding a positive charge near ball X inside a vacuum, there are induced negative charges on the left side of the ball X and induced positive charges on the right side of the ball Y. 2. When ball X is earthed, the Earth will regards ball X and ball Y are the same conductor and ball X and ball Y are positively charged. (Do you know why?) Therefore, the electrons will flow from the Earth to the ball Y to neutralize it. 3. After separating the ball X and ball Y, ball X become negatively charged while ball Y is neutral. 4. Finally, removing the positively charged rod, the ball X and ball Y are negatively charged and neutral.

21. **D**

黎 Sir 提提你 :

1. Option By Columb's Law: $F = \frac{1}{4\pi\varepsilon_\circ}\frac{Q_aQ_b}{r^2}$

- **Option A: For Q1 and Q3, The direction of resultant forces acting on them are to the right.**

- **Option C: For Q1 and Q2, The direction of resultant forces acting on them are to the right and left respectively**

- **Option B: The resultant force on Q2 is zero! However, The resultant force on Q1 is not balanced.**

  The resultant force on Q1 = $F = \frac{1}{4\pi\varepsilon_\circ}\frac{(+2)(-1)}{(r)^2} + \frac{1}{4\pi\varepsilon_\circ}\frac{(+2)(+2)}{(2r)^2} = \frac{-1}{4\pi\varepsilon_\circ r^2}$

- **Option D: The resultant force on all Q1, Q2 and Q3 are not zero!**

  The resultant force on Q1 = $F = \frac{1}{4\pi\varepsilon_\circ}\frac{(+1)(-4)}{(r)^2} + \frac{1}{4\pi\varepsilon_\circ}\frac{(+4)(+4)}{(2r)^2} = 0N$

  The resultant force on Q2 = $F = \frac{1}{4\pi\varepsilon_\circ}\frac{(+1)(-4)}{(r)^2} + \frac{1}{4\pi\varepsilon_\circ}\frac{(+1)(-4)}{(r)^2} = 0N$

  The resultant force on Q3 = $F = \frac{1}{4\pi\varepsilon_\circ}\frac{(+1)(-4)}{(r)^2} + \frac{1}{4\pi\varepsilon_\circ}\frac{(-4)(-4)}{(2r)^2} = 0N$

22.	**D**	**黎 Sir 提提你 :** **1. Electric force on electron to the left ⇒ the right plate is positive while the left plate is negative ⇒ Electric field point from P to Q.** **2. By E = F/Q ⇒ E = $\frac{8\times10^{-18}}{1.6\times10^{-19}} = 50\ N\ C^{-1}$ (from P to Q)**
23.	**B**	**黎 Sir 提提你 :** **1. By $V = \frac{Q}{4\pi\varepsilon_\circ r}$, $V_X = \frac{Q}{4\pi\varepsilon_\circ(3r)} = \frac{Q}{12\pi\varepsilon_\circ r}$** **2. Therefore, $V_Y = \frac{Q}{4\pi\varepsilon_\circ(2r)} = \frac{Q}{8\pi\varepsilon_\circ r} = (\frac{12}{8})\frac{Q}{12\pi\varepsilon_\circ r} = \frac{3V}{2}$**
24.	**C**	**黎 Sir 提提你 :** **1. Before switch open, e.m.f. = (3)(6 + r) … (1)** **3. After switch open, e.m.f. = (I)(3 + 6 + r) … (2)** **4. By inspection, the current should be lower than 3 A, therefore, option D should not be the answer.** **5. Combining (1) and (2) gives 18 + 3r = 9I + Ir … (3)** **6. By substituting I = 2.4 into (3) gives r = 6 ohms** **7. By substituting I = 2.0 into (3) gives r = 0 ohm which is not possible!** **8. By substituting I = 1.6 into (3) gives r = -2.57 ohm which is not possible!** **9. Therefore, the only possible answer is I = 2.4 A!**

25.	D	黎 Sir 提提你 : 1. Voltmeter = 6 V = e.m.f. of the battery ⇒ No potential difference between blub Q ⇒ Blub Q is short-circutied! 2. However, blub P cannot be short-circuited otherwise the current will not pass through the voltmeter in parallel to blub P and so the reading of voltmeter is zero. 3. Therefore, the only possible answer is D.

26.	A	黎 Sir 提提你 : 1. By right-hand grip rule, • The magnetic field due to the current S at point O = towards P • The magnetic field due to the current Q at point O = towards P • The magnetic field due to the current P at point O = towards S (cancel by Q) • The magnetic field due to the current R at point O = towards Q (cancel by S) 2. Therefore, the direction of the resultant magnetic field at the centre O of the square is along OP.

27.	D	黎 Sir 提提你 : 1. The current flow from M to N for the first half period of time decreasingly ⇒ By right hand grip rule ⇒ B-field strength into the coil PQRS decreases! 2. By Lenz's law ⇒ Induced current flow in clockwise direction in coil PQRS to create a magnetic field into the paper to oppose the decrease in magnetic flux linkage into the coil. 3. When the current flow from N to M for the 2nd half period of time increasingly, ⇒ By right hand grip rule ⇒ B-field strength out of the coil PQRS increases. 4. By Len'z law ⇒ Induced current flow in clockwise direction in coil PQRS to crease a magnetic field into the paper to oppose the increase in magnetic flux linkage out of the coil. 5. Therefore, the direction of the induced current in the coil during the time interval from 0 to T is clockwise throughout.

28.	D	黎 Sir 提提你 : 1. By $B = \frac{\mu_o NI}{l}$, B-filed strength is nothing to do with the cross-sectional area and inversely proportional to the length of the coil and directly proportional to the current flowing inside the coil and numbers of turns insider the coil. 2. Therefore, only choice D is the answer.

29.	**B**	**黎 Sir 提提你 :** **1. PQ is found to be higher electric potential ⇒ Negative potential on side SR** **2. The charge carriers in the metal block is electrons ⇒ Electrons are pushed on the side SR by the magnetic force!** **3. By Fleming left hand rule, the magnetic force is pointing towards side SR and the current is flowing to the left ⇒ the magnetic field should be pointing from Q to P.**

30.	**B**	**黎 Sir 提提你 :** **1. r.m.s. of an alternating current as the steady d.c. which converts electric potential energy to other forms in a given pure resistance at the same rate as that of the a.c.** **2. By** $P=\frac{10^2}{R}$ **(d.c) and** $\frac{1}{2}P=\frac{V_{r.m.s.}^{\ 2}}{R}$ **(a.c)** $\Rightarrow \frac{100}{2R}=\frac{V_{r.m.s.}^{\ 2}}{R} \Rightarrow V_{r.m.s.}=5\sqrt{2}\,V$

31.	**D**	**黎 Sir 提提你 :** **1. Assume there are 50 protons and 50 neutrons inside the nucleus of W,** **2. By decay equations:** • $^{100}_{50}W \rightarrow ^{96}_{48}X + ^{4}_{2}\alpha$ • $^{96}_{48}X \rightarrow ^{96}_{49}Y + ^{0}_{-1}\beta$ • $^{96}_{49}Y \rightarrow ^{96}_{50}Z + ^{0}_{-1}\beta$ **3. Therefore, only option (2) and option (3) is the answers.**

32.	A	黎 Sir 提提你 : 1. Radioactive source emits both alpha and gamma radiation. 2. Alpha radiation ⇒ Blocked by paper! 3. Gamma radiation ⇒ intensity halved by 25 mm lead 4. Background radiation = 50 ⇒ Cannot be blocked! 5. Therefore, no matter what kinds of materials, the recorded count rate should be at least 50! ⇒ Option C is not the appropriate answer! 6. Reading of X and Y should be nearly the same since there is no beta radiation! ⇒ Option B should not be the answer! 7. There should be some difference between reading y and reading z since there should be the intensity of gamma radiation can be reduced a bit by even 2 mm of lead. ⇒ Option D is not a suitable choice! 8. Option A is suitable one because the reading of x is 300 ⇒ Reading of alpha radiation = 150 9. And reading of x and y are nearly the same ⇒ No beta radiation! 10. And reading of y and z is difference by 200 ⇒ Some Gamma radiation is blocked! 11. Reading of z = 100 ⇒ Some gamma radiation (50) + Background radiation (50)!

33.	**C**	**黎 Sir 提提你 :** **1.** $Ra \rightarrow Rn + \alpha + 4.9MeV$ $\Rightarrow \quad Ra - (Rn + \alpha) = 4.9MeV = 4.9\times10^{6}\times1.6\times10^{-19}/(3\times10^{8})^{2} = 8.7\times10^{-30}kg$ **2. Therefore, the total mass of a radon nucleus and an alpha particle is** $8.7\times10^{-30}kg$

The end.

黎 sir 簡介 Andy Lai BEng CUHK, MIEEE

5** Physics Economics

- ✧ 畢業於香港中文大學電子工程學系，黎 sir 教室創辦人之一.
- ✧ 超過 15 年教授中學文憑 / IB Diploma / GCE / HSC / SAT / AP / GCSE / IGCSE / IB MYP 課程經驗.
- ✧ 為了與學生一起面對中學文憑試, 黎 sir 親身上陣, 以實力於物理科及經濟科奪取 5**, 證明寶刀未老.
- ✧ 熟悉出題趨勢，教授考試取分技巧；鼓勵同學獨立思考，增強同學理解能力.
- ✧ 善用生活化例子講解，教法生動，增加學習趣味；深入淺出，明白學生學習上的困難和需要.
- ✧ 精心編制筆記，適合中文和英文中學學生就讀；精心編制練習和試題，協助同學盡快掌握答題技巧.
- ✧ 黎 sir 在中學和大學時代已是一名傑出學生，曾獲取的多項學業上和運動上的獎學金及獎項.
- ✧ 曾代表香港參加國際性運動比賽，取得優異成績，又讀得又玩得，絕不是死讀書的書呆子.
- ✧ 任教科目：所有數學科，物理科，化學科，生物科，經濟科，商業科.

黎 sir 教室學生佳績: Excellent Results

- ✧ 首屆香港中學文憑 (HKDSE)，多位學生取得 5/5*/5**級以上佳績. 更有學生考獲 5 科 5**級 2 科 5*級 1 科 5 級優異成績，在全港 72620 考生中，排名 28，入讀港大醫學院.
- ✧ 英國高考 (GCE AS/AL)，多位學生取得 A*/A 最高級別，更有學生考獲 5 科 A*.
- ✧ 國際文憑 (IB Diploma)，多位學生取得 6 / 7 級別，更有學生取得總分 40 分以上.
- ✧ 英國會考 (IGCSE / GCSE)，多位學生取得 A / A*成績，更有學生取得 8 科 A*。
- ✧ 加拿大大學預科 (CESI) 數學課程 MCV4U，取得 98 / 100, 99 / 100 成績。
- ✧ 學生成功拔尖 (EAS)，提早入讀港大理學院和中大法律學院.
- ✧ 香港中學會考 (HKCEE)，多位學生取得 20 分以上佳績.
- ✧ 保加利亞國際數學競賽 (BIMC 2013) 隊際賽金牌.
- ✧ 奧數華夏杯/港澳杯/華杯，多位學生取得特等獎/金獎/一等獎/全港第二名.
- ✧ 還有更多，恕不能盡錄，詳情請瀏覽以下網址: www.andylai.hk/result.htm

黎 sir 教室課程特色:

- ✧ 小組教學 (1 – 6 人)，導師親身教學；照顧每位學生需要，事半功倍.
- ✧ 精心編制筆記，練習以近 30 年本地和外國公開試題為藍本.
- ✧ 概念理解，取分技巧並重；協助同學盡快掌握答題技巧.
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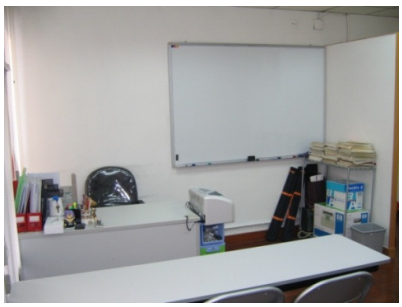

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資深中學補習導師 小組補習 事半功倍!!!

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5** Physics Economics

- ✧ 畢業於香港中文大學，黎 sir 教室創辦人之一.
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- ✧ 現於黎 sir 教室任教補習班，學生就讀於英文中學，中文中學，國際學校及英國留學生.
- ✧ 熟悉近年出題趨勢，教授考試取分技巧；鼓勵同學獨立思考，增強同學理解能力
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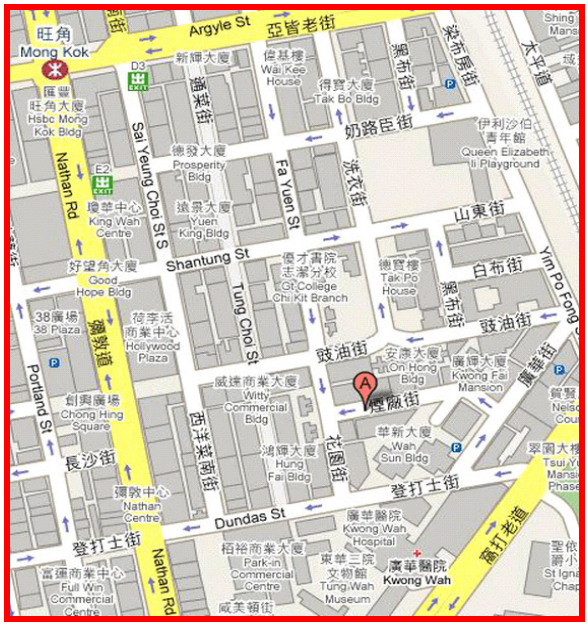
- ✧ 黎 sir 在中學和大學時代已是一名傑出學生，曾獲取多項學業上和運動上的獎學金及獎項；曾代表香港參加國際性運動比賽，取得優異成績，「又讀得又玩得」，絕不是死讀書的書呆子.
- ✧ 黎 sir 在就讀大學時曾於全球最大美資電腦公司任實習生超過一年，大學畢業後旋即於全港大型英資電腦公司，負責主理該公司所代理的全球大型美資電腦公司儲存系統銷售業務.
- ✧ 於短短半年內將該產品線銷售業績提升超過 50%. 同時更被公司評選為"傑出表現員工 Outstanding Performer"，成功將書本上的知識靈活運用於工作上.
- ✧ 黎 sir 為了教學理想，毅然辭去工作，全身投入教學事業，希望將自己的一套學習方法教授學生

黎 sir 教室 課程特色

- ✧ 小組教學 (1 – 6 人)，導師親身教學；照顧每位學生需要，事半功倍.
- ✧ 精心編制筆記，練習以近 30 年本地和外國公開試題為藍本.
- ✧ 概念理解，取分技巧並重；協助同學盡快掌握答題技巧.
- ✧ 歡迎自由組合小組上課，時間及課程內容編排更有彈性.
- ✧ 時間及課程請瀏覽以下網址: www.andylai.hk



地鐵: 旺角 E2 出口，油麻地 A2 出口

小巴: 1, 1A, 2, 3C, 6, 6C, 6F, 9, 30X, 35A, 41A, 42A, 60X, 63X, 68X, 69X, 81S, 87D, 93K, 95, 104, 117, 203, 212, 230X, 234P, 234X, 238P, 238S, 259B, 270P, 281A

小巴: 21K, 74, 74S

黎Sir教室 A Lai Learning Center

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