HKDSE Physics Practice Papers
Samples of Student Performance

High Performance Sample 1: Paper 1 Section B Question 3

3. A smooth curved rail *PQR* is fixed on a horizontal bench as shown in Figure 3.1. *P* is at a height *h* above the bench surface. A small metal ball *X* of mass 0.03 kg is released from rest at *P*.

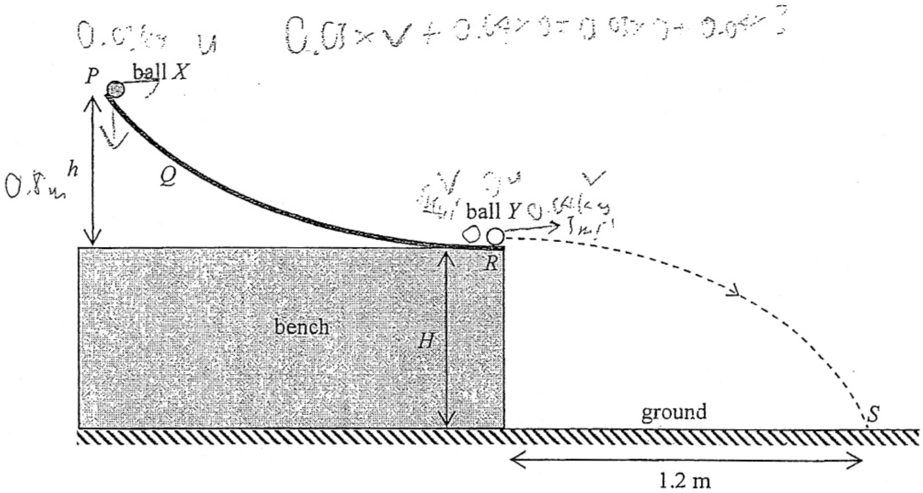


Figure 3.1

When ball *X* reaches *R*, it moves horizontally and collides head-on with another metal ball *Y* of mass 0.04 kg which is initially at rest on the rail. Immediately after the collision, ball *X* comes to rest while ball *Y* moves off the bench horizontally with a speed of 3 m s^{-1}. Neglect air resistance.

(a) What is the speed of ball *X* just before it collides with ball *Y*?

(1 mark)

$V = \frac{0.04 \times 3}{0.03}$

$= 4\ ms^{-1}$ ✓ 1

(b) Find the value of *h*.

(2 marks)

KE gain = PE loss ✓ 1

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

$\frac{1}{2}(4)^2 = (10) h$

$h = 0.8 m$ ✓ 1

(cont'd)

(cont'd) High Performance Sample 1: Paper 1 Section B Question 3

*(c) Ball Y lands on the ground at S which is at a horizontal distance of 1.2 m from the bench. Find the height H of the bench.

(3 marks)

time that Ball Y reach the ground $= 1.2 \div 3$

$= 0.4s$ ✓ 1

$s = ut + \frac{1}{2}at^2$

$= 3(0.4) - \frac{1}{2}(10)(0.4)^2$ ✗ 0

$= 0.4\ m$

$\therefore H = 0.4m$ 0

*(d) Ball X is now released at Q such that ball Y moves off the bench horizontally with a smaller speed after collision. Would the time of flight of ball Y change ? Explain briefly.

(2 marks)

No. The vertical motion and horizontal motion of projectile is independent. ✓ 1
In this case, the time of flight depends on the vertical motion, so
it won't change ✓ though there is change in horizontal motion. 1

High Performance Sample 2: Paper 1 Section B Question 6

6. Figure 6.1 shows the following apparatus:

A low voltage power supply, a ray box with a single slit, a full circle protractor and a semi-circular glass block.

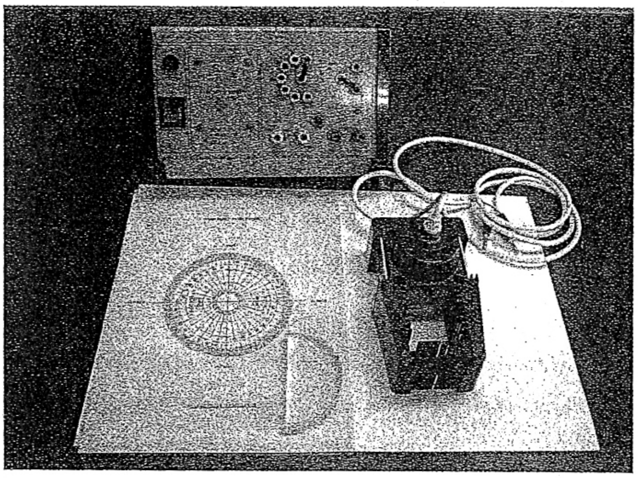


Figure 6.1

Describe how to use the above apparatus to measure the critical angle of the semi-circular glass block.

(5 marks)

First, put the semi-circular glass block on the full circle protractor, make sure the centre of block is exactly at the same position with the origin of the protractor. Then connect the ray box with single slit to the low voltage power supply. Aim the light ray to the centre of circle (ie. origin of the protractor) and make sure the light ray enter from the curved side of glass block perpendicularly. After that, turn the glass block clockwise with the centre still on the position of the origin of protractor. Observe the change. When the refracted ray is lying on the straight side of the glass block (ie. the refracted angle is 90°), mark down the incident angle of the light ray which is difference between on the centre of which is the angular difference between the normal and the incident ray on the centre. It represents the critical angle required.

High Performance Sample 3: Paper 1 Section B Question 11

11. The decay of radioactive isotope protactinium-238 (^{238}Pa) has a half-life of approximately 136 s. A sample of ^{238}Pa is put in front of a GM tube and the initial count rate is 1000 counts per minute. The background count rate is 50 counts per minute.

(a) It is known that the decay of ^{238}Pa does not emit γ radiation. Suggest a simple test to verify the radiation from ^{238}Pa is β radiation but not α radiation.

(3 marks)

Put a piece of thick paper ~~in fm~~ between the source and the GM tube, if the count rate ~~drops significant~~ does not drop significantly ✓ then the decay of ^{238}Pa ~~is~~ probably emits β radiation ~~It is worth noting the experiment sho that~~ 0

It is worth noting that the experiment comparison should be done in vaccum to prevent ionisation of air by α particles that might affect the results. 1 1

*(b) Estimate the decay constant of ^{238}Pa.

(1 mark)

$136 = \frac{\ln 2}{k}$

$k = 5.10 \times 10^{-3}\ s^{-1}$ ✓ 1

*(c) Hence, or otherwise, estimate the time taken for the count rate to drop to 250 counts per minute.

(3 marks)

$(250-50) = (1000-50)\ e^{-(5.10\times10^{-3})t}$ ✓ ✓

$-(5.10\times10^{-3})t = \ln(0.210526)$ 1

$t = 306\ s$ ✓ 1

1

High Performance Sample 4: Paper 2 Question 2

Q.2: Structured question

(a) In studying the photoelectrons emitted from sodium, it was found that no photoelectrons were emitted when the wavelength of the incident light was longer than 5.27×10^{-7} m.

(i) Explain why the wave model of light **cannot** account for this phenomenon.

(2 marks)

This is because the wave model propose that the wavelength is independent from the photoelectric effect while it isn't. The model didn't treat light as discrete energy packets ✗ 0 0

(ii) Determine the work function for sodium. Express your answer in electron-volts.

(3 marks)

$\phi = h\frac{3\times10^8}{5.27\times10^{-7}}$ ✓✓

$\phi = 3.772 \times 10^{-19}$ J 1

$= 2.35$ eV 1

✗ 0

(iii) What is the physical meaning of work function ?

(1 mark)

It is the minimum work required to liberate electrons from its belonging material ✓

1

(cont'd)

(cont'd) High Performance Sample 4: Paper 2 Question 2

(b) Figure 2.1 shows a photoelectric smoke detector Peter made for a science project competition. It consists of a light source S, a photocell C and an alarm circuit. When smoke enters the detector, light from S is scattered by the smoke particles and enters C as shown in Figure 2.2. Photoelectrons are produced in C when light is incident on its sodium surface. The alarm is triggered when the photoelectric current is larger than 1×10^{-8} A.

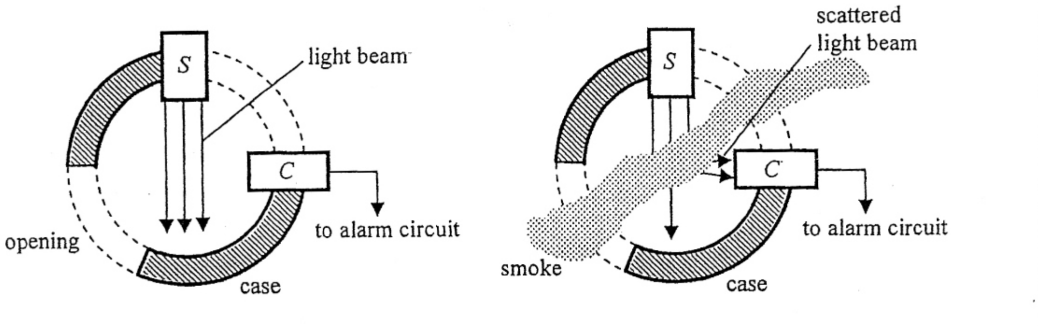


Figure 2.1 Figure 2.2

(i) If 5% of the photons incident on the sodium surface of C emit photoelectrons, what is the minimum number of photons incident on the sodium surface of C in 1 s when the alarm is triggered ?

(2 marks)

~~minimum~~ $\frac{1\times10^{-8}}{1.6\times10^{-19}} \div 5\% = 1.25\times10^{12}$ ✓ ✓

(ii) Peter claimed that the detector will become more sensitive if a light source of the same type as S but of higher intensity is used. Comment on his suggestion.

(2 marks)

~~His statement is false because the size of current induced is independent from the intensity. The intensity of light alters the voltage of current while the frequency of light~~

His statement is true ✓ because higher light intensity produces more photoelectrons due to more number of photons. Thus less smoke is ✓ required to produce the same size of current.

Mid Performance Sample 1: Paper 1 Section B Question 3

3. A smooth curved rail *PQR* is fixed on a horizontal bench as shown in Figure 3.1. *P* is at a height *h* above the bench surface. A small metal ball *X* of mass 0.03 kg is released from rest at *P*.

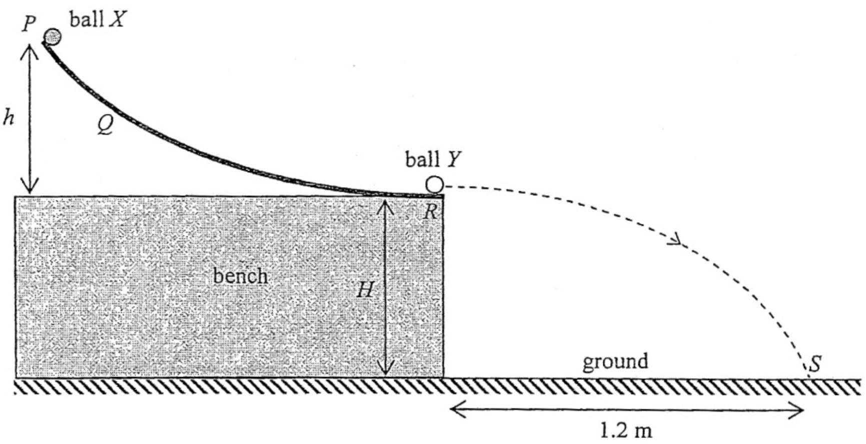


Figure 3.1

When ball *X* reaches *R*, it moves horizontally and collides head-on with another metal ball *Y* of mass 0.04 kg which is initially at rest on the rail. Immediately after the collision, ball *X* comes to rest while ball *Y* moves off the bench horizontally with a speed of 3 m s^{-1}. Neglect air resistance.

(a) What is the speed of ball *X* just before it collides with ball *Y*?

(1 mark)

kinetic energy of ball X before collides with ball Y = kinetic energy of ball Y after collision

$\frac{1}{2}(0.04)(3)^2 = \frac{1}{2}(0.03)v^2$

$v = 3.46 ms^{-1}$ ✗ 0

(b) Find the value of *h*.

(2 marks)

by $\frac{1}{2}mv^2 = mgh$ ✓

$\frac{1}{2}(0.03)(3.46)^2 = (0.03)(9.81)h$ 1

$h = 0.610$ m ✗ 0

(cont'd)

(cont'd) Mid Performance Sample 1: Paper 1 Section B Question 3

*(c) Ball Y lands on the ground at S which is at a horizontal distance of 1.2 m from the bench. Find the height H of the bench.

(3 marks)

By $s = ut + \frac{1}{2}at^2$

$1.2 = 3.46t + 0$ ✗

$t = 0.347$ s 0

By $s = ut + \frac{1}{2}at^2$ 1

$H = 0 + \frac{1}{2}(9.81)(0.347)^2$ ✓

$H = 0.591$ m ✗ 0

*(d) Ball X is now released at Q such that ball Y moves off the bench horizontally with a smaller speed after collision. Would the time of flight of ball Y change? Explain briefly.

(2 marks)

No, it will not ✓ because the vectical velocity is not related to ~~that~~ horizontal velocity of the ball 1
~~That the ba~~ That ball Y moves of the bench horizontally with a smaller speed ~~just affect the distance between the~~ will not affect ✓ the vetical velocity so the time of flight of ball Y will not change. 1

Mid Performance Sample 2: Paper 1 Section B Question 3

3. A smooth curved rail *PQR* is fixed on a horizontal bench as shown in Figure 3.1. *P* is at a height *h* above the bench surface. A small metal ball *X* of mass 0.03 kg is released from rest at *P*.

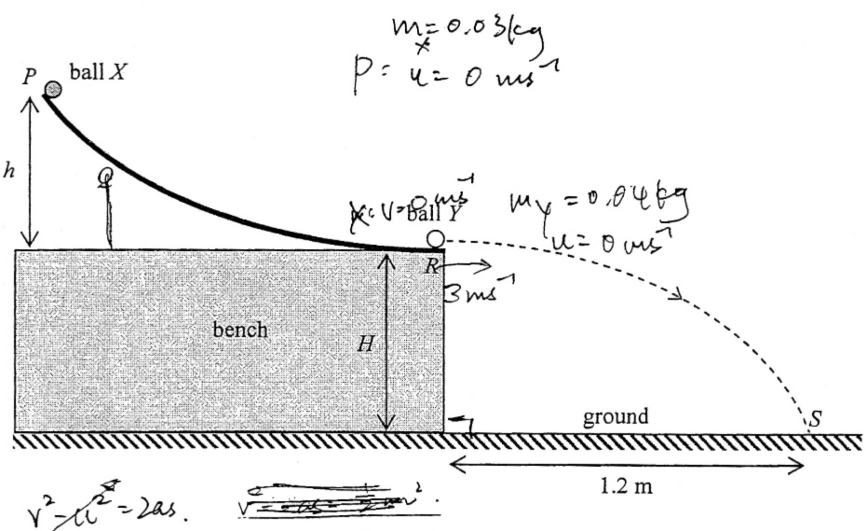


Figure 3.1

When ball *X* reaches *R*, it moves horizontally and collides head-on with another metal ball *Y* of mass 0.04 kg which is initially at rest on the rail. Immediately after the collision, ball *X* comes to rest while ball *Y* moves off the bench horizontally with a speed of 3 m s^{-1}. Neglect air resistance.

(a) What is the speed of ball *X* just before it collides with ball *Y*?

(1 mark)

~~P.E lost = K.E gain~~

~~$mgh = \frac{1}{2}mv^2$~~

~~$\sqrt{2gh} = V$~~

~~$v = \sqrt{2gh}$ m s^{-1}~~

By conservation of momentum.

$m_x u_x + m_y u_y = m_x v_x + m_y v_y$

$0 = 0.03 \times V_x + 0.04 \times 3$

$-0.12 = 0.03 V_x$

$V_x = -4$ m s^{-1} ✗ 0

(b) Find the value of *h*.

(2 marks)

P.E lost = K.E gain ✓

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

$v = \sqrt{2gh}$

$-4 = \sqrt{2gh}$

$16 = 2gh$

$h = \frac{16}{2g}$ 1

$= 0.8$ m ✓ 1

(cont'd)

(cont'd) Mid Performance Sample 2: Paper 1 Section B Question 3

*(c) Ball *Y* lands on the ground at *S* which is at a horizontal distance of 1.2 m from the bench. Find the height *H* of the bench.

(3 marks)

$S_x = u_x t$

$1.2 = 3t$

$t = 0.4$ s ✓ 1

$H = S_y = ut + \frac{1}{2}at^2$

$= (3 \times 0.4) + \frac{1}{2}(10)(0.4)^2$ ✗ 0

$= 2$ m 0

∴ The height H of the bench is 2m. ✗

*(d) Ball *X* is now released at *Q* such that ball *Y* moves off the bench horizontally with a smaller speed after collision. Would the time of flight of ball *Y* change ? Explain briefly.

(2 marks)

~~The time of flight of ball Y change: From the equation, The ball X gain speed from the height (mgh), and if the height is reduced, the speed gain by ball X decreases. And hence, the velocity of Y change which affect the horizontal distance moved~~

The time of flight of ball Y remain unchange. ✓ 1

From the equation, $S_x = u_x t$, t is only affected by S_x and u_x. As S_x change together with u_x. Hence, t is remain unchange. ✗ 0

Mid Performance Sample 3: Paper 1 Section B Question 6

6. Figure 6.1 shows the following apparatus:

A low voltage power supply, a ray box with a single slit, a full circle protractor and a semi-circular glass block.

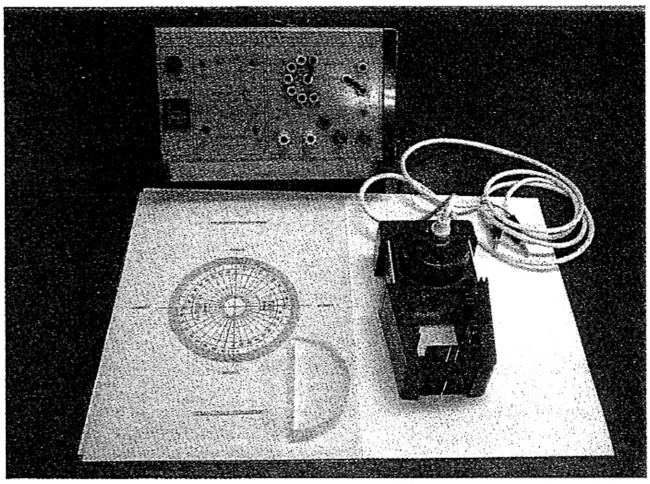


Figure 6.1

Describe how to use the above apparatus to measure the critical angle of the semi-circular glass block.

(5 marks)

First, connect the ray box with the power supply ✓. Then, put the semi-circular glass on the full circle protractor ✓. Put the ray box with single slit in front of the semi-circular glass. lighting the from the arc of glass to the origin ✓. Then, turn the circle protractor and the glass to find the critical angle. When there is no refraction and only reflection, the angle is critical angle. ✗

1

1

1

0

0

Mid Performance Sample 4: Paper 1 Section B Question 11

11. The decay of radioactive isotope protactinium-238 (^{238}Pa) has a half-life of approximately 136 s. A sample of ^{238}Pa is put in front of a GM tube and the initial count rate is 1000 counts per minute. The background count rate is 50 counts per minute.

(a) It is known that the decay of ^{238}Pa does not emit γ radiation. Suggest a simple test to verify the radiation from ^{238}Pa is β radiation but not α radiation.

(3 marks)

Put a cardboard of several cm thick in front of the GM tube. If the reading of the GM tube drops significantly, the radiation will be α radiation. So, the reading should not change significantly which proves β radiation is emitted. ✓

0
1
1

*(b) Estimate the decay constant of ^{238}Pa.

(1 mark)

$N = N_0 e^{-kt}$ $k = 5.10 \times 10^{-3}\ s^{-1}$ ✓ (corr. to 3 sig. fig.)

$\frac{N_0}{2} = N_0 e^{-k(136)}$

$\ln 0.5 = -k(136)$

1

*(c) Hence, or otherwise, estimate the time taken for the count rate to drop to 250 counts per minute.

(3 marks)

$N = N_0 e^{-kt}$, $A = A_0 e^{-kt}$

✗ $250 = 1000 e^{-k(t)}$ ✓

$\ln 0.25 = -kt$

$t = \frac{\ln 0.25}{-5.10 \times 10^{-3}}$

$= 272\ s$ (corr. to 3 sig. fig.) ✗

0
1
0

Mid Performance Sample 5: Paper 1 Section B Question 11

11. The decay of radioactive isotope protactinium-238 (^{238}Pa) has a half-life of approximately 136 s. A sample of ^{238}Pa is put in front of a GM tube and the initial count rate is 1000 counts per minute. The background count rate is 50 counts per minute.

(a) It is known that the decay of ^{238}Pa does not emit γ radiation. Suggest a simple test to verify the radiation from ^{238}Pa is β radiation but not α radiation.

(3 marks)

We can put the sample of ^{238}Pa β in front of a GM tube first, ~~and put a paper between the sample and GM tube~~. Record the count rate. Secondly, put a paper ✓ between the sample and the GM tube. Record the count rate. If the two count rate is similar ✓, that means there are no α radiation. ~~The read~~ Then, ~~the~~ if the two count rate is higher than 50 counts per minute, there is β radiation.

0
1
1

*(b) Estimate the decay constant of ^{238}Pa.

(1 mark)

The decay constant of 238 Pa $= \frac{\ln 2}{136}$

$= 5.10 \times 10^{-3}\ s^{-1}$ ✓ 1

*(c) Hence, or otherwise, estimate the time taken for the count rate to drop to 250 counts per minute.

(3 marks)

The time take for the count rate to drop to 250 counts per minute

$= \frac{1000}{250} \times 136$ 0

$= 544$ s ✗ 0

0

Mid Performance Sample 6: Paper 2 Question 4

Q.4: Structured question

The table below shows the linear attenuation coefficient, μ, of X-rays for different tissues.

Tissue	bone	liver	muscle	lung	air
Linear attenuation coefficient/cm^{-1}	4.00	0.85	0.84	0.20	0.10

(a) Suggest one reason to explain why the linear attenuation coefficient of the lung is smaller than that of the liver.

(1 mark)

There are gases inside the lung. ✓ 1

(b) Show that the half-value thickness = $\frac{\ln 2}{\mu}$.

(2 marks)

Let the half value thickness be x

$\frac{1}{2}A_0 = A_0 e^{-\mu x}$ ✓

$\ln\frac{1}{2} + \ln A_0 = \ln A_0 - \mu x \ln e$ 1

$-\ln 2 = -\mu x$ ✓ 1

$x = \frac{\ln 2}{\mu}$ (proved)

(c) The intensity of a beam of X-ray drops to 1/8 of its initial value after passing through a lung. Estimate the thickness of the lung.

(2 marks)

$\frac{1}{8} = (\frac{1}{2})^3$ ✓

The thickness = $\frac{\ln 2}{0.2} \times 3$ 1

= 10.4 cm ✓ 1

(cont'd)

(cont'd) Mid Performance Sample 6: Paper 2 Question 4

(d) Figure 4.1 shows an X-ray radiographic image of a patient's chest. Explain why the bones appear white in colour.

(2 marks)

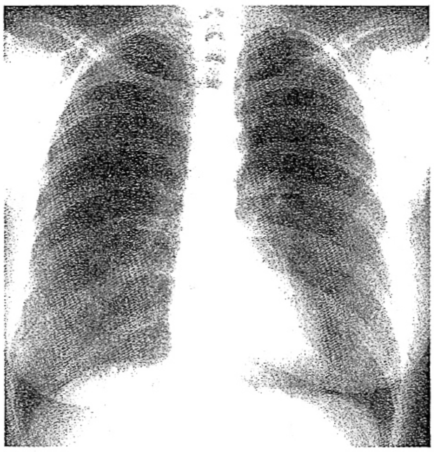


Figure 4.1

It is because there is only little x-ray passed through the bone. The senor can only detect a ~~the~~ few x-ray at those position with bones. ✗ Thus, there is white in colour.

0

0

(e) Artificial contrast medium is sometimes used to highlight an organ in X-ray radiographic imaging. Suggest **two** properties that an artificial contrast medium should have.

(2 marks)

The half-life of the medium should not be too long. It should be several hours or one day. ✗

0

Also, this medium should be absorbable by the required organ. ✗

0

(f) Suggest one advantage of X-ray radiographic imaging over CT scan.

(1 mark)

~~The~~ The patients expose in environment with ~~les~~ fewer x-ray, that they may not bitter ~~or~~ or even no complications. ✓

1

END OF PAPER

Low Performance Sample 1: Paper 1 Section B Question 6

6. Figure 6.1 shows the following apparatus:

A low voltage power supply, a ray box with a single slit, a full circle protractor and a semi-circular glass block.

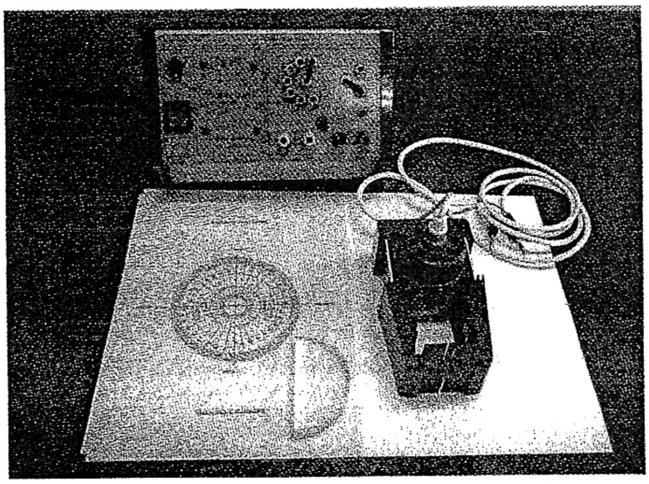


Figure 6.1

Describe how to use the above apparatus to measure the critical angle of the semi-circular glass block. (5 marks)

Place the glass block on ~~a side of~~ the protractor such that ~~diameter~~ straight side of block lies on north south direction of protractor. Produce a beam pointing at centre of block so ~~that~~ light beam is perpendicular to the straight side of the block. Slowly rotate the full circle protractor. Diffraction is observed with some internal reflection. Record the angle just when no diffraction is observed, but total internal reflection.

0
1
0
0
0

Low Performance Sample 2: Paper 1 Section B Question 11

$t_{1/2} = 136s$

11. The decay of radioactive isotope protactinium-238 (^{238}Pa) has a half-life of approximately 136 s. A sample of ^{238}Pa is put in front of a GM tube and the initial count rate is 1000 counts per minute. The background count rate is 50 counts per minute.

(a) It is known that the decay of ^{238}Pa does not emit γ radiation. Suggest a simple test to verify the radiation from ^{238}Pa is β radiation but not α radiation.

(3 marks)

Set up a charged parallel plate with identify positive and negative terminals. Eject the ^{238}Pa into the electric plate. β radiation can be identified if it is attracted to the positively charged plate and α radiation can be identified if it is attracted to the negatively charged plate.

✗ 0 0 0

*(b) Estimate the decay constant of ^{238}Pa.

(1 mark)

By $t_{1/2} = \frac{\ln 2}{k}$

$k = \frac{\ln 2}{t_{1/2}}$

$= \frac{\ln 2}{136}$

$k = 5.097 \times 10^{-3}$

✗ 0

*(c) Hence, or otherwise, estimate the time taken for the count rate to drop to 250 counts per minute.

(3 marks)

By $A = A_0 e^{-kt}$ ✓

$250 = (1000 - 50) e^{-5.097 \times 10^{-3} t}$ ✓

$0.263157894 = e^{-5.097 \times 10^{-3} t}$ 1

$\ln 0.263157894 = \ln e^{-5.097 \times 10^{-3} t}$ 1

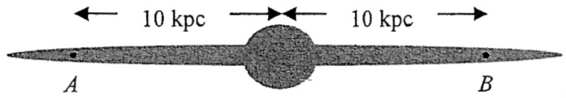
$\ln 0.263157894 = -5.097 \times 10^{-3} t$

$t = 261.9 s$ ✗ 0

Low Performance Sample 3: Paper 2 Question 1

Q.1: Structured question

(a) We observe a galaxy X as shown in Figure 1.1. X has negligible velocity relative to the Earth. Points A and B are both 10 kpc from the centre. The wavelengths of the H-alpha lines from the hydrogen gas at points A and B are 656.83 nm and 655.73 nm respectively. The wavelength of the H-alpha line measured in the laboratory is 656.28 nm.



edge-on view of galaxy X

Figure 1.1

(i) Determine the speed of the hydrogen gas at point A along the line of sight of an observer on the Earth.

(1 mark)

$\frac{v}{c} = \frac{\Delta\lambda}{\lambda}$

$\frac{v}{3\times10^8} = \frac{656.83-655.73}{656.83}$

$V = 5.024 \times 10^5 \text{ ms}^{-1}$ ✗

0

(ii) Briefly explain at which point, A or B, the hydrogen gas is moving towards the Earth.

(2 marks)

Point B, because the λ of point B is small than the number of point A, so it is a blue shift, so it is moving towards the Earth.

1

1

(iii) Assuming that the hydrogen gas at points A and B are moving in a circular path around the centre of X, and that the mass of X is concentrated at its centre, estimate the mass of X.

(2 marks)

✗

0

0

(cont'd)

(cont'd) Low Performance Sample 3: Paper 2 Question 1

(b) Observations were made on another galaxy *Y*, as shown in Figure 1.2.

Figure 1.2

(i) The angular separation between points *C* and *E* is 1.6°. Given that *Y* is 950 kpc from the Earth, express the separation between *C* and *E* in kpc.

(2 marks)

$\tan 1.6° = \frac{1}{d}$ ✗ 950

$d = 35.8$ AU

$d = \frac{35.8 \times 1.5 \times 10^{11}}{3.09 \times 10^{16}}$ 0

0

$d = 1.74 \times 10^{-4}$ pc

$d = 1.74 \times 10^{-7}$ kpc ✗

(ii) Further observations show that the velocities of hydrogen gas at points *D* and *E* along the line of sight of an observer on the Earth are about the same. What could be inferred about the mass distribution of *Y*? Assume that the hydrogen gas at points *D* and *E* are moving in circular paths around the centre of *Y*.

(1 mark)

✗ 0

(c) Briefly explain how we can estimate the surface temperature of a star by analyzing its radiation.

(2 marks)

When the star surface temperature is higher the λ will be small, it trend to Ultraviolet. If the star surface temperature is lower the λ of ~~the~~ star will ~~be~~ increas. So we can know that the ~~tem~~ surface temperature of a star. ✓ 0 1

Low Performance Sample 4: Paper 2 Question 2

Q.2: Structured question

(a) In studying the photoelectrons emitted from sodium, it was found that no photoelectrons were emitted when the wavelength of the incident light was longer than 5.27×10^{-7} m.

(i) Explain why the wave model of light **cannot** account for this phenomenon.

(2 marks)

For a wave, energy transfered is independent of wavelength, thus frequency, but dependent of intensity. ✓

1

0

(ii) Determine the work function for sodium. Express your answer in electron-volts.

(3 marks)

$\phi = hf_0$ ✓

$= \frac{hc}{\lambda}$

$= \frac{6.63\times10^{-34} \times 3\times10^{8}}{5.27\times10^{-7}} = 3.77\times10^{-19}$ J ✓

ϕ in electron-volts $= \frac{3.77\times10^{-19}}{1.60\times10^{-19}} = 2.36$ eV ✓

1

1

1

(iii) What is the physical meaning of work function ?

(1 mark)

The minimum energy ~~required~~ of a photon required to excite the surface of a metal to emit electrons. ✗

0

(cont'd)

(cont'd) Low Performance Sample 4: Paper 2 Question 2

(b) Figure 2.1 shows a photoelectric smoke detector Peter made for a science project competition. It consists of a light source S, a photocell C and an alarm circuit. When smoke enters the detector, light from S is scattered by the smoke particles and enters C as shown in Figure 2.2. Photoelectrons are produced in C when light is incident on its sodium surface. The alarm is triggered when the photoelectric current is larger than 1×10^{-8} A.

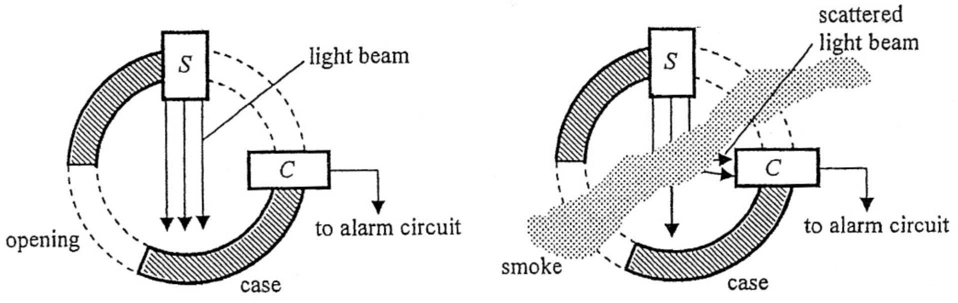


Figure 2.1 Figure 2.2

(i) If 5% of the photons incident on the sodium surface of C emit photoelectrons, what is the minimum number of photons incident on the sodium surface of C in 1 s when the alarm is triggered?

(2 marks)

$\frac{1 \times 10^{-8}}{3.77 \times 10^{-19}} = 2.65 \times 10^{10}$ ~~ele~~ photons

X 0

0

(ii) Peter claimed that the detector will become more sensitive if a light source of the same type as S but of higher intensity is used. Comment on his suggestion.

(2 marks)

~~Inten~~ Higher intensity increases number of ~~ef electron~~ photoelectrons emitted ~~but~~ would not increase maximum K.E. of the photoelectrons. So ~~only current~~ the alarm gets more sensitive as more ~~elect~~ electrons are emitted to form higher current.

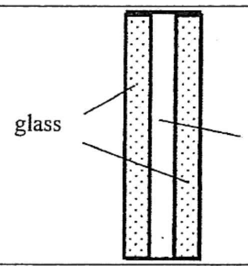
X 0

0

Low Performance Sample 5: Paper 2 Question 3

Q.3: Structured question

(a) The heat transfer through a window can be reduced by using double-glazed glass. The table below shows some information of two types of windows, both made from the same type of glass.

		
Type	Single layer	Double-glazed
Thickness	0.01 m	0.03 m (0.01 m for each layer)
Thermal transmittance U-value	5.7 W m^{-2} K^{-1}	2.8 W m^{-2} K^{-1}

(i) Suggest **two** reasons why the thermal transmittance of the double-glazed window is smaller than that of the single layer window.

(2 marks)

Air is a good insulator of heat. ✓
Thicker wall ✓ of glass slower the conduction of heat.

1
1

(ii) On a hot sunny afternoon, the temperatures outside and inside a room are 36°C and 24°C respectively.

(1) If the double-glazed window is used in the room and the area of the window is 2 m^2, estimate the rate of heat transfer due to conduction through this window.

(1 mark)

$u = \frac{k}{d}$

$2.8 = \frac{k}{0.03}$

$k = 0.084 \ W K^{-1}$

The rate of heat transfer

$= \frac{kA(T_H - T_c)}{d}$

$= \frac{0.084(2)(36-24)}{0.03} = 67.2W$ ✓

1

(2) Briefly explain whether the actual rate of heat transfer will be higher or lower than your answer in part (1).

(2 marks)

The actual rate of heat transfer will be lower than the answer in part (1) since some heat will be lose to surrounding. ✗

0
0

(cont'd)

(cont'd) Low Performance Sample 5: Paper 2 Question 3

(a) (iii) Other than using double-glazed windows, suggest one method to reduce the heat flow through windows.

(1 mark)

E-coating.

X 0

(b) An air-conditioner is installed in a room to keep the room cool.

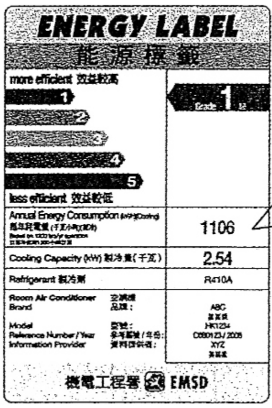
(i) Briefly explain how the refrigerant in an air-conditioner absorbs heat from the room.

(2 marks)

There will be some fans and compressers in the air-conditioner.

X 0 0

(ii) The energy label of the air-conditioner is shown in Figure 3.1.



Annual energy consumption (kWh)(cooling)
Based on 1200 hrs/yr operation = 1106

Cooling capacity (kW) = 2.54

Figure 3.1

Estimate the amount of heat that can be removed from the room by the air-conditioner in 5 minutes.

(2 marks)

= 2.54 × 1000 × $\frac{5}{60}$ X

= 212 J // X

0 0

Low Performance Sample 6: Paper 2 Question 4

Q.4: Structured question

$\frac{\mu}{cm} =$

The table below shows the linear attenuation coefficient, μ, of X-rays for different tissues.

Tissue	bone	liver	muscle	lung	air
Linear attenuation coefficient/cm^{-1}	4.00	0.85	0.84	0.20	0.10

(a) Suggest one reason to explain why the linear attenuation coefficient of the lung is smaller than that of the liver.

(1 mark)

Because there are many air inside the lung. ✓

1

(b) Show that the half-value thickness = $\frac{\ln 2}{\mu}$.

(2 marks)

$I = I_0 e^{-\mu x}$

$x = \frac{\ln 2}{\mu}$ ✗

0

0

(c) The intensity of a beam of X-ray drops to 1/8 of its initial value after passing through a lung. Estimate the thickness of the lung.

(2 marks)

$I = I_0 e^{-\mu x}$

$\frac{1}{8} = e^{-0.2x}$ ✓

$x = 10.4 cm$ ✓

1

1

(cont'd)

(cont'd) Low Performance Sample 6: Paper 2 Question 4

(d) Figure 4.1 shows an X-ray radiographic image of a patient's chest. Explain why the bones appear white in colour.

(2 marks)

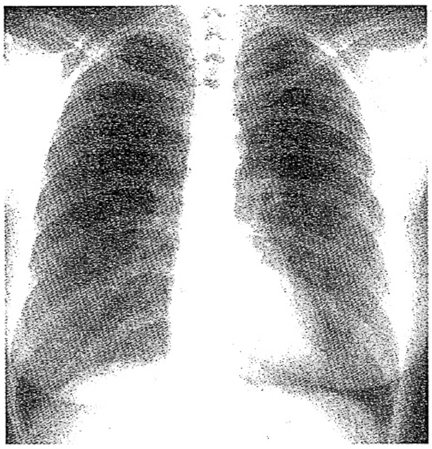


Figure 4.1

⓪ Because the X-ray cannot penetrate the bone and ⓪ reflecting back. Thus, the bone will be white in clor. ✗

0

0

(e) Artificial contrast medium is sometimes used to highlight an organ in X-ray radiographic imaging. Suggest **two** properties that an artificial contrast medium should have.

(2 marks)

First, it should be high density ⓪ which would not ~~reflec~~ make the X-ray reflact. ✗

Second, it should be transparant. ✗

0

0

(f) Suggest one advantage of X-ray radiographic imaging over CT scan.

(1 mark)

It is lower cost that mean cheaper than CT scan. ✓

1