HKDSE Combined Science (Physics) Practice Papers
Samples of Student Performance

High Performance Sample 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*.

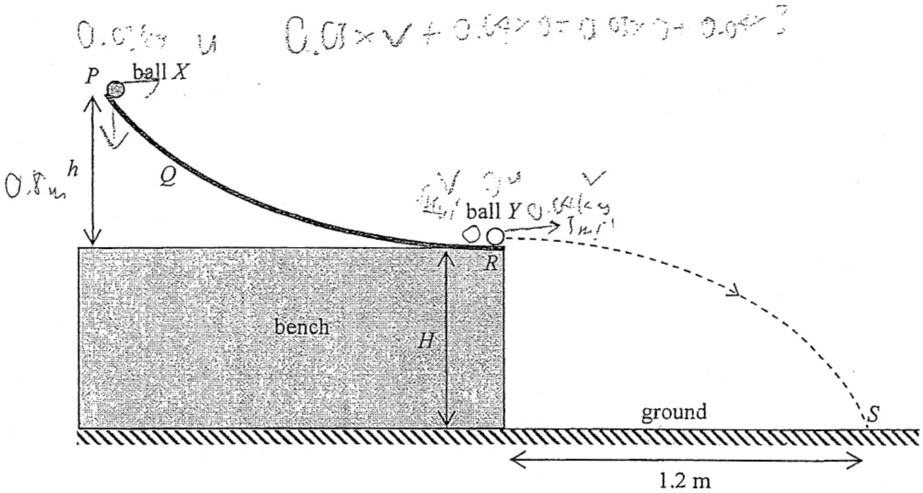


Figure 3.1

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: 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 ÷ 3

= 0.4 s ✓ 1

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

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

$= 0.4$ m

∴ H = 0.4 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. 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: Section B Question 5

5. Figure 5.1 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.

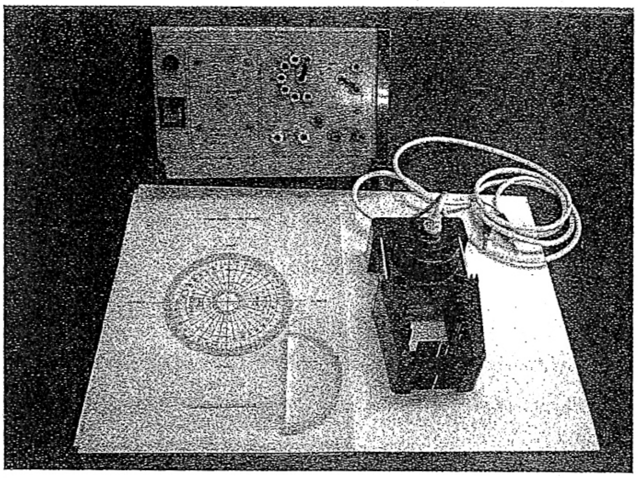


Figure 5.1

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 ~~pow~~ 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 ~~perpen~~ 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 ~~reflected ray~~ refracted ray is lying on the straight side of the glass block (ie. the refracted angle is 90°), ~~Make~~ ~~Mark~~ mark down the incident angle of the light ray ~~from the~~ on ~~which is~~ difference between the ~~centre of~~ which is the angular difference between the normal and the incident ray on the centre. It represents the critical angle required.

Mid Performance Sample 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*.

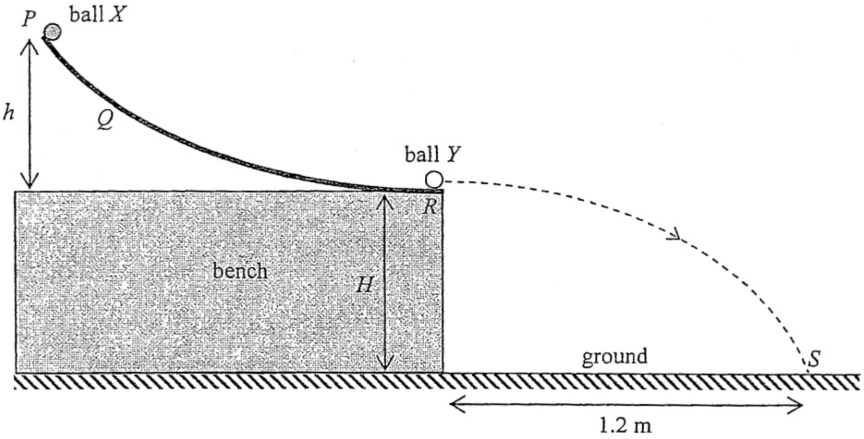


Figure 3.1

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)

~~By ½mv² = ½mv²~~

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: 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 horizontal velocity of the ball — 1

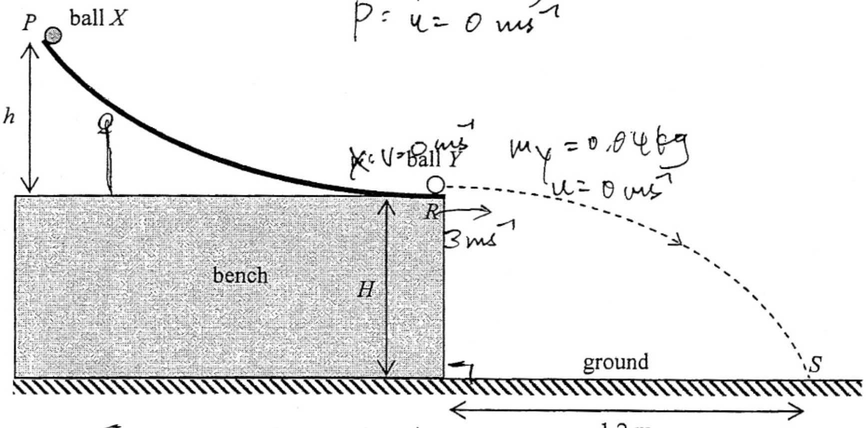
That ball Y moves of the bench horizontally with a smaller speed ~~just affect the distance between the~~ will not affect ✓ the vetical velocity so the time of flight of ball Y will not change. — 1

Mid Performance Sample 2: 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.

$m_X = 0.03$ kg

$P: u = 0$ m s^{-1}



$v^2 - u^2 = 2as$.

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

~~$mgh = \frac{1}{2}mv^2$~~ By conservation of momentum.

~~$\sqrt{2gh} = v$~~ $m_X u_X + m_Y u_Y = m_X v_X + m_Y v_Y$

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

$-0.12 = 0.03 V_X$

$V_X = -4$ m s^{-1} ✗

(b) Find the value of h.

(2 marks)

P.E lost = K.E gain ✓

$mgh = \frac{1}{2}mv^2$ $h = \frac{16}{2g}$ 1

$v = \sqrt{2gh}$

$-4 = \sqrt{2gh}$ $= 0.8$ m ✓ 1

$16 = 2gh$

(cont'd)

(cont'd) Mid Performance Sample 2: 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. ✓

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. ✗ 1 0

Mid Performance Sample 3: Section B Question 5

5. Figure 5.1 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.

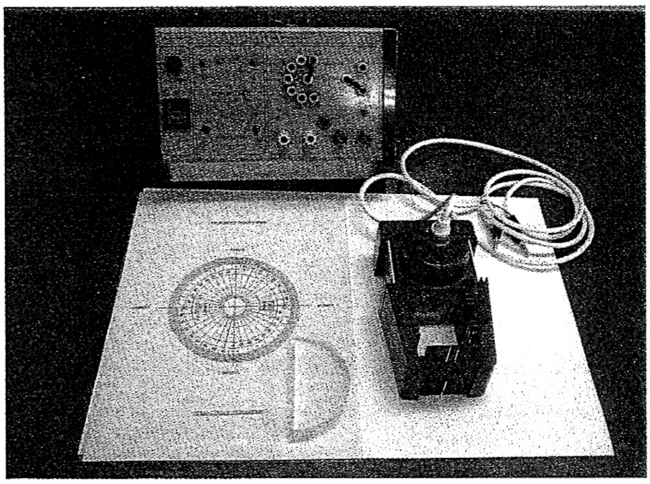


Figure 5.1

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

(5 marks)

~~Wh~~ 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

Low Performance Sample 1: Section B Question 5

5. Figure 5.1 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.

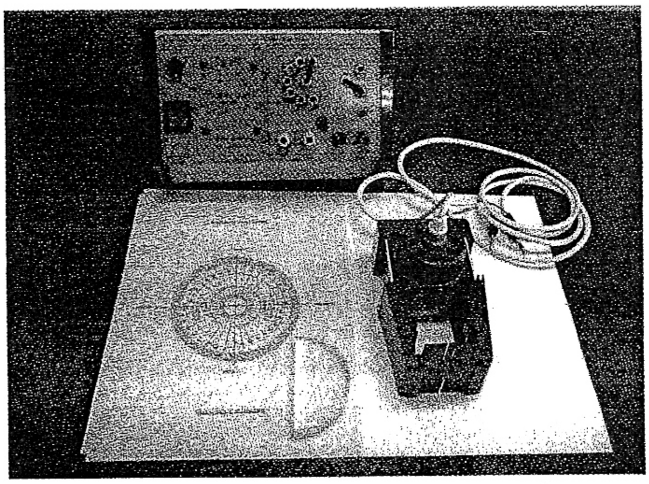


Figure 5.1

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

Place the glass block ~~a~~ 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 ~~p~~ 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