PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Spring Semester 2017**

College of Arts and Sciences

Section **Quiz 8-1** **April 2017**

Closed book. No calculators are to be used for this quiz.

Quiz duration: 10 minutes

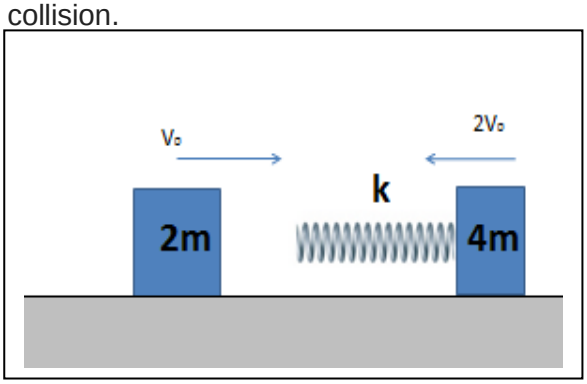
Name: **Student ID:** **Signature:**

A block of mass **2m** moving to the right with a speed of $\mathbf{V_0}$ on a frictionless surface collides with a light spring attached to a second block of mass **4m** initially moving to the left with a speed of $\mathbf{2V_0}$ as shown in Figure. The spring constant is **k.**

a) Find the velocities of the two blocks when the spring reaches its maximum compression.

b) Calculate the maximum compression of the spring.

c) Find the velocities of the blocks after the collision.



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Spring Semester 2017**

College of Arts and Sciences

Section **Quiz 8-2** **April 2017**

Closed book. No calculators are to be used for this quiz.

Quiz duration: 10 minutes

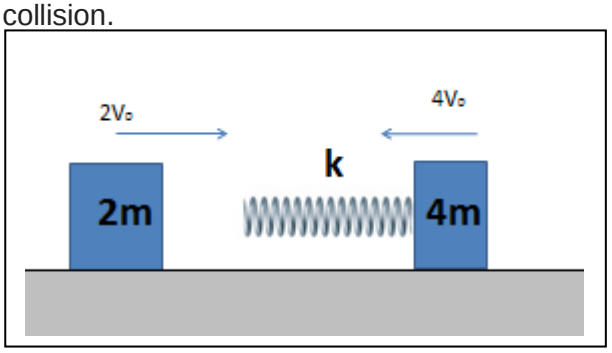
Name: **Student ID:** **Signature:**

A block of mass 2m moving to the right with a speed of $2V_0$ on a frictionless surface collides with a light spring attached to a second block of mass 4m initially moving to the left with a speed of $4V_0$ as shown in Figure. The spring constant is **k.**

a) Find the velocities of the two blocks when the spring reaches its maximum compression.

b) Calculate the maximum compression of the spring.

c) Find the velocities of the blocks after the collision.



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Spring Semester 2017**

College of Arts and Sciences

Section **Quiz 8-3** **April 2017**

Closed book. No calculators are to be used for this quiz.

Quiz duration: 10 minutes

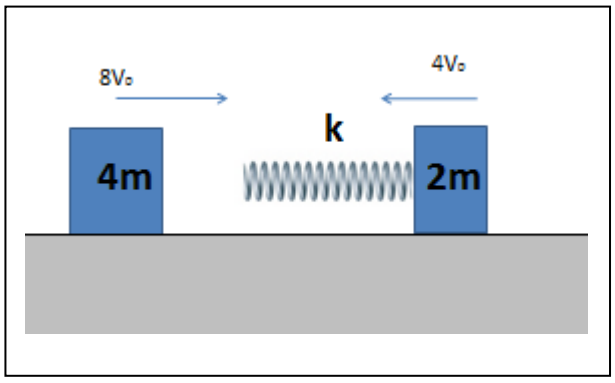
Name: **Student ID:** **Signature:**

A block of mass 4m moving to the right with a speed of $8V_0$ on a frictionless surface collides with a light spring attached to a second block of mass 2m initially moving to the left with a speed of $4V_0$ as shown in Figure. The spring constant is **k.**

a) Find the velocities of the two blocks when the spring reaches its maximum compression.

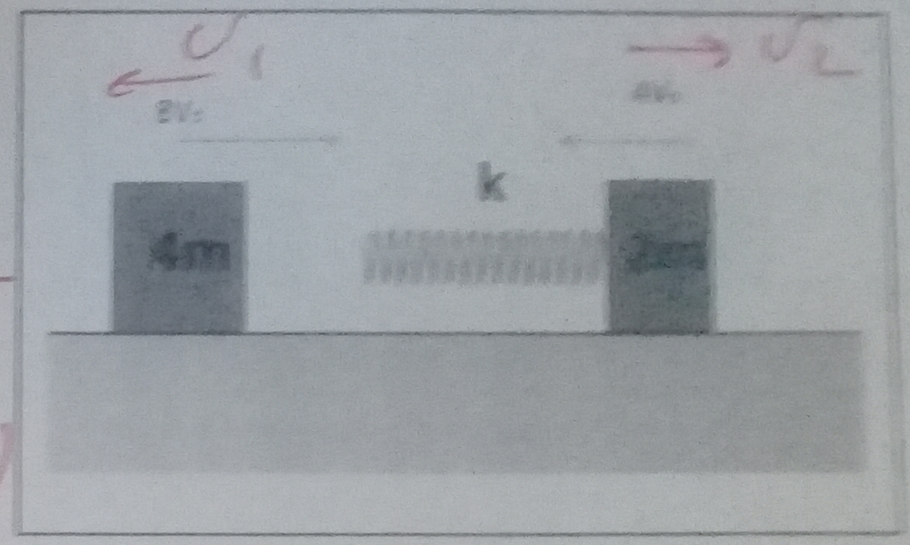
b) Calculate the maximum compression of the spring.

c) Find the velocities of the blocks after the collision.



b) Calculate the maximum compression of the spring

c) Find the velocities of the blocks after the collision



a) they will have equal speed

momentum cons. :

$-4m \cdot 8v_c + 2m \cdot 4v_c = (4m+2m)\,v$

$v = -4v_c$ (to the right)

b) energy cons:

$\frac{1}{2}\,4m(8v_c)^2 + \frac{1}{2}\,2m(4v_c)^2 = \frac{1}{2}(4m+2m)(-4v_c)^2 + \frac{1}{2}kx^2$

$\Rightarrow x^2 = \frac{192\,m v_c^2}{k}$

c) momentum cons. $\Rightarrow$ $-24v_c = 4v_1 - 2v_2$

energy cons $\Rightarrow$ $144v_c^2 = 2v_1^2 + v_2^2$

subtract

$v_1 = -8v_c$

$v_2 = -4v_c$

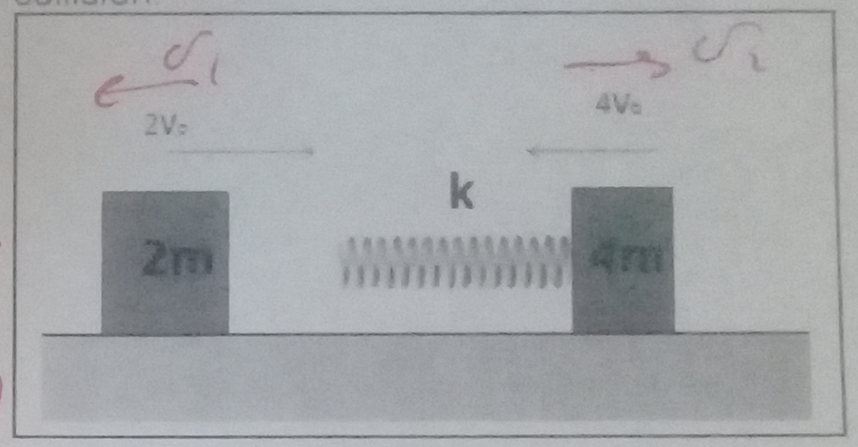
$v_1 = 0$

$v_2 = 4\sqrt{2}\,v_c$ ✓

35 a) Find the velocities of the two blocks when the spring reaches its maximum compression

35 b) Calculate the maximum compression of the spring

30 c) Find the velocities of the blocks after the collision



a) they will have equal speed.

momentum cons. :

$$-2m.2v_0 + 4m.4v_0 = (2m+4m)v$$

$$v = 2v_0 \quad (\text{to the left})$$

b) Energy cons. :

$$\frac{1}{2}\,2m(2v_c)^2 + \frac{1}{2}\,4m(4v_c)^2 = \frac{1}{2}(2m+4m)(2v_0)^2 + \frac{1}{2}kx^2$$

$$\Rightarrow x^2 = \frac{48mv_c^2}{k}$$

c) momentum cons. $\Rightarrow$ $12v_c = 2v_1 - 4v_2$

energy cons $\Rightarrow$ $36v_c^2 = v_1^2 + 2v_2^2$

solutions:

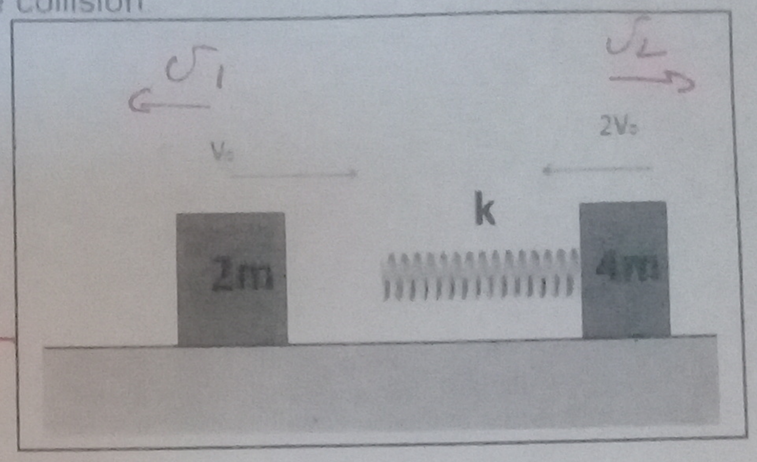
$v_1 = -2v_c$, $v_2 = -4v_c$ — initial case

$v_1 = 6v_c$, $v_2 = 0$ ✓

35 a) maximum compression

35 b) Calculate the maximum compression of the spring

30 c) Find the velocities of the blocks after the collision



a) they will have equal speed.

momentum conservation leads to

$-2m.v_0 + 8mv_0 = (2m+4m)v$

$v = +v_0$ (to the left)

b) Energy conservation,

$\frac{1}{2}.2m v_0^2 + \frac{1}{2}\,4m(2v_0)^2 = \frac{1}{2}(2m+4m)(+v_0)^2 + \frac{1}{2}kx^2$

$\Rightarrow x^2 = \frac{12mv_0^2}{k}$

c) momentum cons. $\Rightarrow$ $\bullet\ 6v_0 = 2v_1 - 4v_2$

energy " $\Rightarrow$ $9v_0^2 = v_1^2 + 2v_2^2$

solutions → $v_1 = -v_0$, $v_2 = -2v_0$ initial case

→ $v_1 = 3v_0$

$v_2 = 3v_0$ ✓