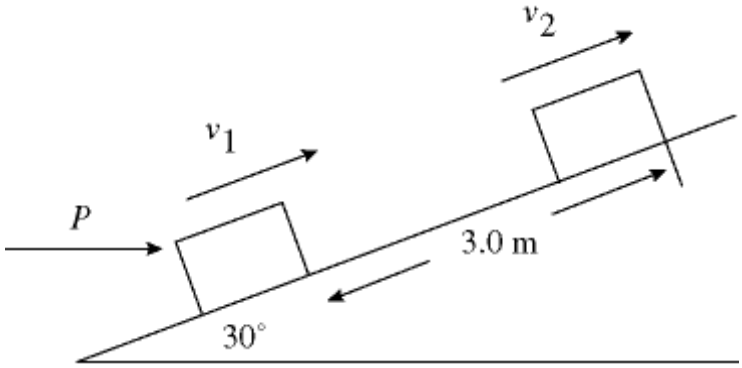
Exam PHYS 4A WINTER 2015 QUIZ 4

Name_Professor S.K. Sinha_____

1 hour =60 mins 1 min = 60 secs. g= 9.8 m s–2 VERSION A

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Figure 6.2



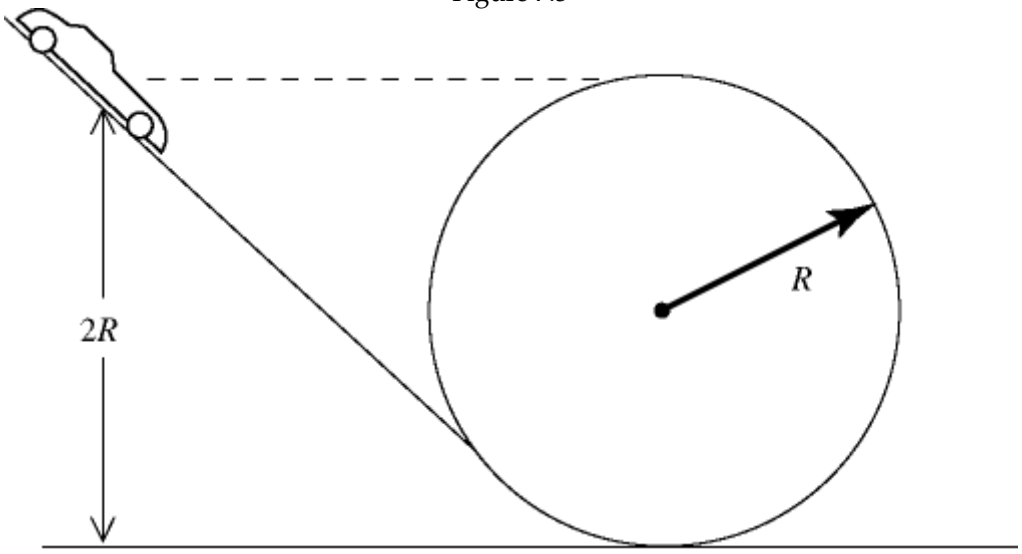
1) In Fig. 6.2, a 700–kg crate is on a rough surface inclined at 30°. A constant external force $P = 5600$ N is applied horizontally to the crate. The force pushes the crate a distance of 3.0 m up the incline, in a time interval of 8.3 s, and the velocity changes from $v_1 = 1.4$ m/s to $v_2 = 2.3$ m/s. The work done by the friction force is closest to:

A) +3100 J B) +5400 J C) –5400 J D) –3100 J E) zero

2) A sand mover at a quarry lifts 2,000 kg of sand per minute a vertical distance of 12 meters. The sand is initially at rest and is discharged at the top of the sand mover with speed 5 m/s into a loading chute. At what minimum rate must power be supplied to this machine?

A) 6.65 kw B) 3.92 kw C) 1.13 kw D) 4.34 kw E) 524 w

Figure 7.3



3) In Fig. 7.3, a toy race car of mass m is released from rest on the loop–the–loop track. If it is released at a height $2R$ above the floor, how high is it above the floor when it leaves the track, neglecting friction?

A) 1.33 R B) 1.25 R C) 2.00 R D) 1.50 R E) 1.67 R

4) Two stones, one of mass m and the other of mass $2m$, are thrown directly upward with the same velocity at the same time from ground level and feel no air resistance. Which statement about these stones is true?

A) Both stones will reach the same height because they initially had the same amount of kinetic energy.

B) At their highest point, both stones will have the same gravitational potential energy because they reach the same height.

C) The heavier stone will go twice as high as the lighter one because it initially had twice as much kinetic energy.

D) At its highest point, the heavier stone will have twice as much gravitational potential energy as the lighter one because it is twice as heavy.

E) The lighter stone will reach its maximum height sooner than the heavier one.

As Per Version A

QUIZ #4 SOLUTIONS

PHYS 4A

WINTER '15

Q 1.) This Problem will not be graded due to inconsistencies in the formulation of the problem.

Q 2.) $P = \frac{dW}{dt}$

in 1 min $\rightarrow$ $W = \Delta U + \Delta K$

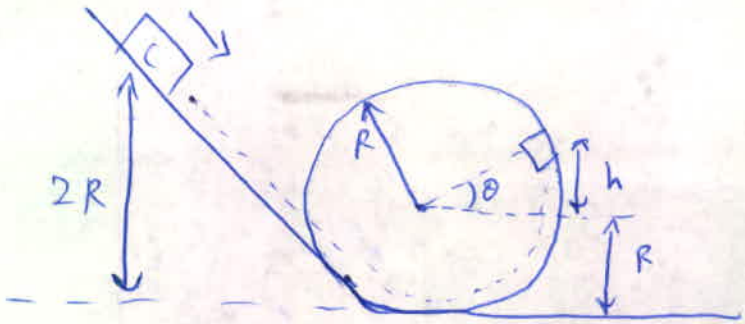
$= (2000 \times g \times 12 - 0) + \frac{1}{2} \times 2000 \times 5^2$

$= 2.602 \times 10^5 \text{ J}$

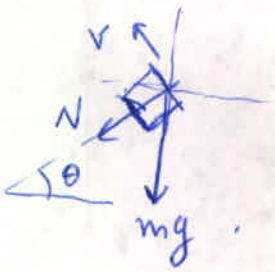
$\therefore \quad P = \frac{2.602 \times 10^5 \text{ J}}{1 \text{ min}} = \frac{260.2 \text{ kJ}}{60 \text{ s}}$

$= 4.34 \text{ kW}$

3.)



Let the angle be θ when it leaves the track.



$$\therefore \quad N + mg\sin\theta = \frac{mv^2}{R}.$$

But $N = 0$ just when it leaves the track

$$mg\sin\theta = \frac{mv^2}{R} \qquad -(1)$$

By energy conservation,

$$\Delta U + \Delta K = W_{nc} = 0.$$

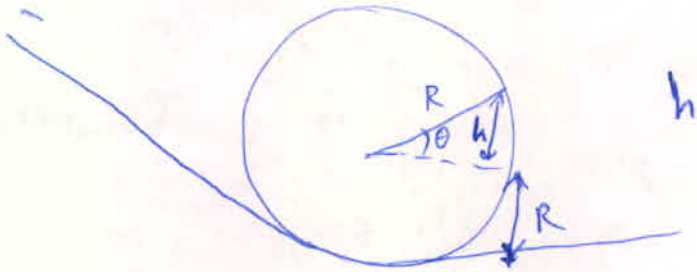
$$\Rightarrow \quad U_f - U_i + K_f - K_i = 0.$$

$$\Rightarrow \quad mg(R+h) - mg(2R) + \underbrace{\frac{1}{2}mv^2}_{\text{↓}} - 0 = 0$$

$$\Rightarrow \quad -mgR + mgh + \frac{1}{2}\underbrace{(mg\sin\theta R)}_{\hookrightarrow (\text{from eq}^{n}\ (1))} = 0$$

$\Rightarrow R \sin\theta = 2(R-h)$

Also,



$h = R \sin\theta$.

$\therefore R \sin\theta = 2R - 2R\sin\theta$

$\Rightarrow \sin\theta = \frac{2}{3}$

$\therefore h = \frac{2R}{3}$

$\therefore$ Total height $= R + \frac{2R}{3}$

$= 1.6 > R$

4.) D.

Since acceleration ($9.8\ m/s^2$), and initial velocity is same for both the stones, they will reach the same maximum height.

For $m \rightarrow \Delta U = mgh$. For $2m \rightarrow \Delta U = (2m)gh$