

This print-out should have 11 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

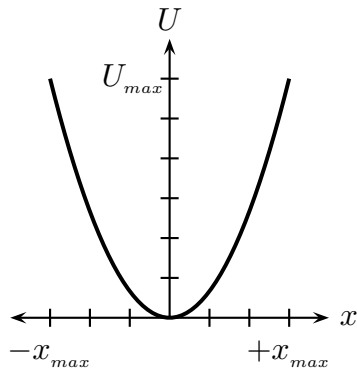
Please remember to carry out your calculations to at least 3 sig figs! The server will mark your answer incorrect if it is not within 1 percent of their answer.

AP B 1998 MC 8

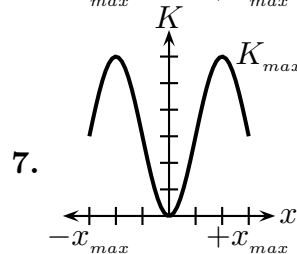
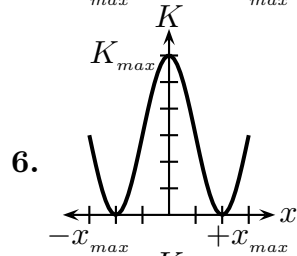
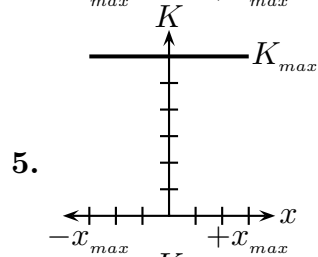
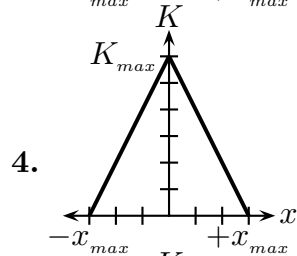
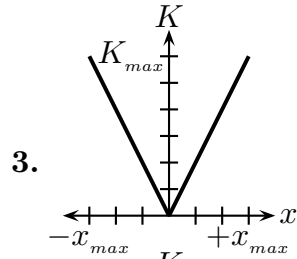
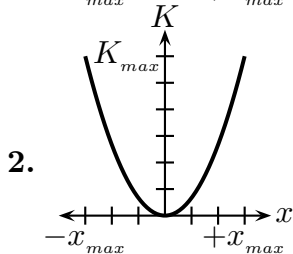
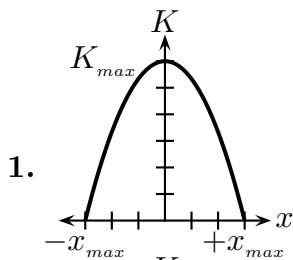
13:04, trigonometry, multiple choice, < 1 min, fixed.

001

The graph below represents the potential energy U as a function of displacement x for an object on the end of a spring ($F = -kx$) oscillating in simple harmonic motion with amplitude x_{max} .



Which graph represents the kinetic energy K of the object as a function of displacement x ?

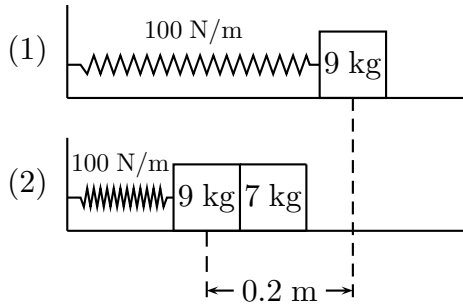


Serway CP 13 67

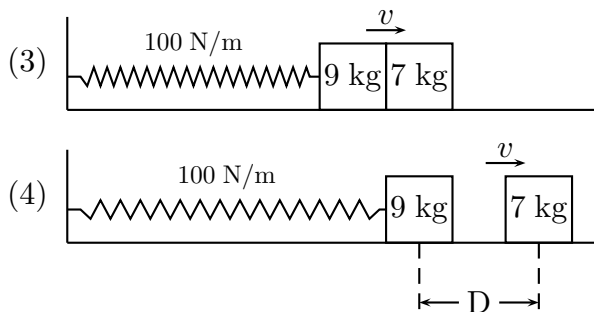
13:04, trigonometry, numeric, > 1 min, normal.

002

An object of mass 9 kg is in equilibrium while connected to a light spring of constant 100 N/m that is fastened to a wall. A second object of mass 7 kg is slowly pushed up against mass m_1 , compressing the spring by the amount 0.2 m.



The system is then released, causing both masses to start moving to the right on the frictionless surface. When m_1 is at the equilibrium point (see (3)), m_2 loses contact with m_1 and moves to the right with speed v .



Find the value of v . Answer in units of m/s.

003

How far apart are the objects when the spring is fully stretched for the first time? Answer in units of cm.

Horizontal Spring Oscillation 02

13:02, trigonometry, numeric, > 1 min, wording-variable.

004

A 50 g mass is attached to a horizontal spring with a spring constant of 10 N/m and released from rest with an amplitude of 25 cm.

What is the velocity of the mass when it is halfway to the equilibrium position if the surface is frictionless? Answer in units of m/s.

Gravity on a New Planet

13:05, trigonometry, numeric, > 1 min, normal.

005

Having landed on a newly discovered planet,

an astronaut sets up a simple pendulum of length 0.7 m and finds that it makes 120 complete oscillations in 446 s. The amplitude of the oscillations is very small compared to the pendulum's length.

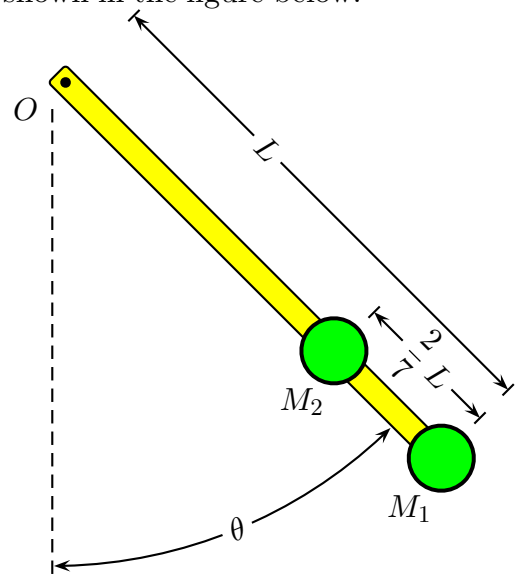
What is the gravitational acceleration on the surface of this planet? Answer in units of m/s^2 .

Masses on a Pendulum 03

13:06, calculus, multiple choice, > 1 min, normal.

006

Consider a light rod of negligible mass and length L pivoted on a frictionless horizontal bearing at a point O . Attached to the end of the rod is a mass M_1 . Also, a second mass M_2 of equal size (i.e., $M_1 = M_2 = M$) is attached to the rod ($\frac{2}{7}L$ from the lower end), as shown in the figure below.



What is the period of this pendulum in the small angle approximation?

1. $T = 2\pi \sqrt{\frac{37}{42} \frac{L}{g}}$
2. $T = 2\pi \sqrt{\frac{65}{77} \frac{L}{g}}$
3. $T = 2\pi \sqrt{\frac{41}{45} \frac{L}{g}}$

$$4. T = 2\pi \sqrt{\frac{53 L}{63 g}}$$

$$5. T = 2\pi \sqrt{\frac{17 L}{20 g}}$$

$$6. T = 2\pi \sqrt{\frac{73 L}{88 g}}$$

$$7. T = 2\pi \sqrt{\frac{29 L}{35 g}}$$

$$8. T = 2\pi \sqrt{\frac{5 L}{6 g}}$$

$$9. T = 2\pi \sqrt{\frac{85 L}{99 g}}$$

$$10. T = 2\pi \sqrt{\frac{89 L}{104 g}}$$

Two Wires Stretched

12:10, trigonometry, numeric, > 1 min, normal.

007

Two wires made of the same material are stretched by equal forces. The second wire is twice as long as the first one and also has twice the diameter of the first wire.

If the first wire is stretched by $\Delta L_1 = 1$ cm, then by how long is the second wire stretched? Answer in units of cm.

Serway CP 09 08

12:11, trigonometry, numeric, > 1 min, normal.

008

The distortion of the Earth's crystal plates is an example of shear on a large scale. A particular crystal rock has a shear modulus of 1.5×10^{10} Pa.

What shear stress is involved when a 10 km layer of this rock is sheared through a distance of 5 m? Answer in units of Pa.

Tallest Concrete Pillar

12:11, trigonometry, numeric, > 1 min, normal.

009

1 m^3 of concrete weighs 50000 N. The compression strength of concrete is $1.7 \times$

10^7 N/m^2 .

What is the height of the tallest cylindrical pillar, made from this amount of concrete, that will not collapse under its own weight? Answer in units of m.

Serway CP 09 74

15:06, trigonometry, numeric, > 1 min, normal.

010

The small piston of a hydraulic lift has a cross-sectional area of 3 cm^2 and the large piston 200 cm^2 .

What force must be applied to the small piston for the lift to raise a load of 15 kN? (In service stations, this force is usually exerted by compressed air.) Answer in units of N.

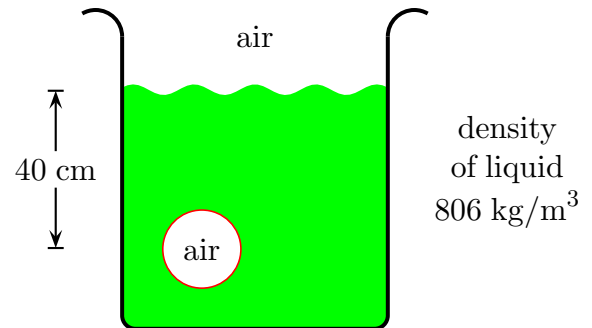
Air Bubble in Ethanol

15:04, trigonometry, numeric, > 1 min, normal.

011

The air pressure above the liquid in figure is 1.1 atm. The depth of the air bubble in the liquid is 40 cm and the liquid's density is 806 kg/m^3 .

The acceleration of gravity is 9.8 m/s^2 .



Determine the air pressure in the bubble suspended in the liquid. Answer in units of Pa.