Question 1

If the length of the Achilles tendon increases 0.50 cm when the force exerted on it by the muscle increases from 3200 N to 4800 N, what is the "spring constant" of the tendon?

- A) 2800 N/cm
- B) 3200 N/cm
- C) 3000 N/cm
- D) 4000 N/cm

Question 2

The length of a spring increases by 7.2 cm from its relaxed length when a mass of 1.4 kg is suspended from the spring. (a) What is the spring constant? (b) A different mass is suspended and the spring length increases by 12.2 cm from its relaxed length. What is the second mass?

A) (a) 2.8 N/cm; (b) 2.0 kg B) (a) 0.7 N/cm; (b) 2.0 kg C) (a) 1.9 N/cm; (b) 3.0 kg D) (a) 1.9 N/cm; (b) 2.4 kg E) (a) 2.8 N/cm; (b) 2.4 kg

Question 3

A 4.0-kg object is lifted 1.5 m. (a) How much work is done against the Earth's gravity? (b) Repeat if the object is lowered instead of lifted.

- A) (a) 59 J, (b) -59 J
- B) (a) 6 J, (b) -6 J C) (a) -59 J, (b) 59 J
- D) (a) 39 J, (b) -39 J

Question 4

A proton (m=1.67 x 10^{-27} kg) that has a speed of 5.0 x 10^6 m/s passes through a metal film of thickness 0.010 mm and emerges with a speed of 2.0 x 10^6 m/s. How large an average force opposed its motion through the film?

A) 1.8 x 10⁻⁹ N B) 7.5 x 10⁻¹⁰ N C) 3.3 x 10⁻¹⁰ N D) 3.5 x 10⁻¹² N

Question 5

A 200-kg cart is pushed slowly up an incline. How much work does the pushing force do in moving the cart up to a platform 1.5 m above the starting point of friction is negligible?

- A) 1.96 kJ
- B) 2.94 kJ
- C) 0.30 kJ
- D) 4.41 kJ

Question 6

Just before striking the ground, a 2.0-kg mass has 400 J of KE. If friction can be ignored, from what height was it dropped?

- A) 200 m
- B) 20 m
- C) 40.8 m
- D) 40.0 m

Question 7

At sea level a nitrogen molecule in the air has an average translational KE of 6.2 x 10-21J. Its mass is 4.7×10^{-26} kg. (a) If the molecule could shoot straight up without striking other air molecules, how high would it rise? (b) What is the molecule's initial speed?

A) (a) 14 km, (b) 0.51 km/s

- B) (a) 1.35 x 10⁴⁶, b) 2.64 x 10⁵
- C) (a) 132 km, (b) 0.36 km/s
- D) (a) 7.9 x 10-7, (b) 0.26 km/s

Question 8

A bead slides on a wire. Let A and B be two different points on the wire such that point A is a height h higher than point B. How large must height h1 be if the bead, starting at rest at A, is to have a speed of 200 cm/s at point B? Ignore friction.

- A) 10.2 cm
- B) 20.4 cm
- C) 40.8 cm
- D) 78.4 cm

Question 9

Compute the power output of a machine that lifts a 500-kg crate through a height of 20.0 m in a time of 60.0 s.

- A) 1.63 KW
- B) 0.082 kW
- C) 98 kW
- D) 0.167 kW

Question 10

A 1000-kg auto travels up a 3.0 percent grade at 20 m/s. Find the horsepower required, neglecting friction.

- A) 5880 hp
- B) 263 hp
- C) 7.9 hp
- D) 4.4 x 106 hp

Question 11

A barge of mass 5.0×104 kg is pulled along the Erie Canal by two mules, walking along towpaths parallel to the canal on either side of it. The ropes harnessed to the mules make angles of 45° to the canal. Each mule is pulling on its rope with a force of

1.0 kN. How much work is done on the barge by both of these mules together as they pull the barge 150 m along the canal?

- A) 350 kJ
- B) 210 kJ
- C) 150 kJ
- D) 110 kJ

Question 12

Sam pushes a 10.0-kg sack of bread flour on a frictionless horizontal surface with a constant horizontal force of 2.0 N starting from rest. (a) What is the kinetic energy of the sack after Sam has pushed it a distance of 35 cm? (b) What is the speed of the sack after Sam has pushed it a distance of 35 cm?

A) (a) 0.70 J; (b) 0.37 m/s B) (a) 7.0 J; (b) 0.37 m/s

C) (a) 0.70 J; (b) 0.21 m/s

- D) (a) 7.0 J; (b) 3.5 m/s
- E) (a) 3.5 J; (b) 3.5 m/s