Sample Questions

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

1) If I weigh 650 N on Earth and 5320 N on the surface of a nearby planet, what is the acceleration due to gravity on that planet? 1) _____

A) 92.2 m/s^2 B) 58.5 m/s^2 C) 80.2 m/s^2 D) 69.8 m/s^2

Weight = mass x acceleration due to gravity; g' = g*w'/w

2) A boy throws a rock with an initial velocity of 2.30 m/s at 30.0° above the horizontal. How long does it take for the rock to reach the maximum height of its trajectory? 2) _____

A) 0.117 s B) 0.207 s C) 0.324 s D) 0.230 s

voy = 2.3 m/s sin(30.deg); vy = voy + at, where vy = 0 for max point, a = –g

3) A satellite is in orbit around a planet. The orbital radius is 29.0 km and the gravitational acceleration at that height is 3.7 m/s^2. What is the satellite's orbital speed? 3) _____

A) 330 m/s B) 100 m/s C) 33 m/s D) 10 m/s

use **mv*v/r = mg**

4) A 15 kg block is on a ramp which is inclined at 20° above the horizontal. It is connected by a string to a 19 kg mass which hangs over the top edge of the ramp. Assuming that frictional forces may be neglected, what is the magnitude of the acceleration of the 19 kg block? 4) _____

A) 3.8 m/s^2 B) 4.5 m/s^2 C) 4.2 m/s^2 D) 4.0 m/s^2

T–m1gsin(theta) = m1*a; m2g–T = m2a; solve for a and use given values

5) A 0.140 kg baseball is thrown with a velocity of 42.3 m/s. It is struck with an average force of 5000.0 N, which results in a velocity of 37.0 m/s in the opposite direction. How long were the bat and ball in contact? 5) _____

A) 1.59 x 10^{-2} s B) 3.82 x 10^{-2} s C) 2.22 x 10^{-3} s D) 5.33 x 10^{-3} s

t = change in momentum/force

6) A particle experiences a force given by $F = \alpha - \beta x^3$. Find the potential field the particle is in. (Assume that the zero of potential energy is located at $x = 0$.) 6) _____

A) $U(x) = -3\beta x^2$ B) $U(x) = -\alpha x + \frac{\beta}{4}x^4$

C) $U(x) = \alpha x - \frac{\beta}{4}x^4$ D) $U(x) = 3\beta x^2$

Integral of F w.r.t. x = change in potential energy

7) A 6.7 kg object moving at 7.3 m/s collides inelastically with a 4.0 kg object which is initially at rest. What percentage of the initial kinetic energy of the system is lost during the collision? 7) _____

A) 33 % B) 30 % C) 43 % D) 37 %

m1v0 = (m1+m2)V; V = m1v0/(m1+m2); change in ke = 1/2(m1+m2)V^2 – 1/2m1v0^2; % = change/initial ke *100

8) A force $\vec{F} = 12\,\hat{i} - 10\,\hat{j}$ N acts on an object. How much work does this force do as the object moves from the origin to the point $\vec{r} = 14\,\hat{i} + 11\,\hat{j}$ m? 8) _____

A) 78 J B) 278 J C) 46 J D) 58 J

Work = dot product of F and r.

9) A force $F = bx^3$ acts in the x–direction. How much work is done by this force in moving an object from $x = 0.0$ m to $x = 2.2$ m? The value of b is 3.7 N/m^3. 9) _____

A) 22 J B) 9 J C) 30 J D) 26 J

work = integral of Force w. r. t. x

10) Suppose we want a satellite to revolve around the Earth 3 times a day. What should the radius of its orbit be? (Neglect the presence of the moon.) 10) _____

A) 2.11 x 10^7 m B) 0.49 x 10^7 m C) 2.03 x 10^7 m D) 6.09 x 10^7 m

Use these two equations: mv2/r = GmM/r^2; T = 2*pi*r/v

11) What is the ratio of the escape speed of a rocket launched from sea level and one launched from Mt. Everest (altitude 8.85 km)? 11) _____

A) 0.9993 B) 1.0007 C) 0.9986 D) 1.0014

use this formula twice : vescape = sqrt(2GM/(R+h)) for h = 0 and h = 8.85km, and take the ratio

12) Calculate the average power needed to spin a uniform, solid disk of mass 4.9 kg and radius 0.70 m from rest to 5.0 rad/s in 2.3 s. 12) _____

A) 5.2 W B) 6.5 W C) 7.8 W D) 9.1 W

P = 1/2 Iw^2/time; I = 1/2MR^2 for a solid disk.

13) A solid disk of radius 1.60 m and mass 2.30 kg rolls without slipping to the bottom of an inclined plane. If the angular velocity of the disk is 5.04 rad/s at the bottom, what is the height of the inclined plane? 13) _____

A) 4.98 m B) 4.38 m C) 5.98 m D) 3.74 m

mgh = 1/2*Iw^2+1/2*mv^2

14) A 3.42 kg mass hanging vertically from a spring on the Earth (where $g = 9.8$ m/s^2) undergoes simple oscillatory motion. If the spring constant is 12 N/m, find the period of oscillation of this setup on the moon, where $g = 1.6$ m/s^2. 14) _____

A) 2.51 s B) 4.36 s C) 5.70 s D) 3.35 s

T = 2*pi*sqrt(m/k)

15) The period of a simple pendulum in a grandfather clock on another planet is 1.67 s. What is the acceleration due to gravity on this planet? Assume that the length of the pendulum is 1.00 m. 15) _____

A) 15.6 m/s^2 B) 17.0 m/s^2 C) 13.2 m/s^2 D) 14.2 m/s^2

From T = 2*pi*sqrt(l/g), find g

16) How much would a lead brick 2.0 in x 2.0 in x 7.0 in weigh if placed in oil with density $\varrho = 0.93$ g/cm^3? ($\varrho_{Pb} = 11.4$g/cm^3) 16) _____

A) 4.8 kg B) 0.43 kg C) 0.29 kg D) 5.2 kg

W = V*density*g; Weight in the liquid, W' = W– Weight displaced = W–V*oil density*g

17) Calculate the pressure exerted on the ground by an 85 kg person standing on one foot. Assume that the bottom of the person's foot is 13 cm wide and 28 cm long. 17) _____

A) 2.3 x 10^3 Pa B) 2.3 x 10^4 Pa C) 5.8 x 10^4 Pa D) 5.3 x 10^4 Pa

P = F/A

18) A constant–volume gas thermometer is filled with air whose pressure is 104 Pa at the triple point of water. What would the pressure be at 185 K? 18) _____

A) 486 Pa B) 6.51 x 10^{-3} Pa C) 70.4 Pa D) 154 Pa

From PV = nRT, two states can be related as: P2V2/T2 = P1V1/T1, where V1 = V2

19) An ideal gas is in a closed container. If its pressure is 132 Pa initially, and its temperature is 20.0° C, what is its pressure after its temperature is raised to 60.0° C? 19) _____

A) 44 Pa B) 116 Pa C) 150 Pa D) 396 Pa

Use PV = nRT for two states

20) 0.20 g of hydrogen gas are held in a rigid container. The temperature of the gas is changed from 50 K to 350 K. How much heat is needed? 20) _____

A) 370 J B) 750 J C) 250 J D) 500 J

Q = m*c*tempchange

21) A 24.0 kg sample of ice is at 0.00° C. How much heat is needed to melt it? (For water L_f = 334 kJ/kg and L_v = 2257 kJ/kg.) 21) _____

A) 0.00 kJ B) 8.02×10^3 kJ C) 2.19×10^6 kJ D) 5.42×10^4 kJ

Q = mLf

22) A system has a heat source supplying heat at a rate of 149 W and is doing work at a rate of 104.3 W. At what rate is the internal energy of the system changing? 22) _____

A) −44.7 W B) 149 W C) 44.7 W D) 253.3 W

d**E/dt = dW/dt + dQ/dt, dW/dt = –104.3W**

Answer Key
Testname: SAMPLEQUESTIONSFINAL

1) C
2) A
3) A
4) D
5) C
6) B
7) D
8) D
9) A
10) C
11) B
12) B
13) A
14) D
15) D
16) A
17) B
18) C
19) C
20) A
21) B
22) C