Final Exam 12/4/1438H

University* _____ name _____

Take g = 9.8 ms^{-2} where ever needed

1 From Hook's law, $F=-kx$, where F is the force with dimension of (MLT^{-2}), and x is spring extended length. The dimension of the spring constant k is:

a) MT^2 **b)** ML^2T^2 **c)** MT^{-2} **d)** $ML^{-2}T^{-2}$ **e)** $ML^{-2}T^2$

2 A man inside a balloon moving upward at 7 m/s. He drops a box from a height of 20 m above the ground. The velocity of the box just before touching the ground is:

a) 14 m/s **b)** 21 m/s **c)** 20 m/s **d)** 22 m/s **e)** 34 m/s

3 A jet plane accelerates on a runway from rest at 4 m/s^2. After 5 sec, the velocity of the jet is:

a) 10 m/s **b)** 30 m/s **c)** 50 m/s **d)** 25 m/s **e)** 20 m/s

4 $\mathbf{A} = 3\,\mathbf{i} - 2\,\mathbf{j}$ and $\mathbf{B} = 2\,\mathbf{i} - \mathbf{j}$. The magnitude of the vector $\mathbf{C} = 2\,\mathbf{A} - \mathbf{B}$ is:

a) 5.0 **b)** 4.1 **c)** 6.1 **d)** 3.0 **e)** 7.2

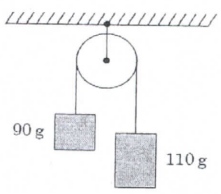
5 At t = 0, a particle leaves the origin with a velocity of 5 m/s in the positive y direction. Its acceleration is given by $\mathbf{a} = (3\,\mathbf{i} - 2\,\mathbf{j})$ m/s^2. At the instant the particle reaches its maximum y coordinate how far is the particle from the origin?

a) 11 m **b)** 14 m **c)** 17 m **d)** 7 m **e)** 19 m

6 The initial speed of a cannon ball is 0.2 km/s. If the ball is to strike a target that is at a horizontal distance of 3 km from the cannon, the minimum time of flight for the ball is:

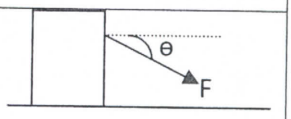
a) 14.3 s **b)** 15.1 s **c)** 16.3 s **d)** 10.3 s **e)** 13.2 s

7 Two blocks are connected by a string and pulley as shown. Assuming that the string and pulley are massless, the magnitude of the acceleration of each block is:



a) 0.049 m/s^2 **b)** 0.020 m/s^2
c) 0.98 m/s^2 **d)** 0.0098 m/s^2
e) 0.54 m/s^2

8 A 12 kg box rests on a horizontal surface and a boy pulls it with a force makes 30° below the horizontal. If the coefficient of static friction is 0.4, the minimum magnitude of the force needed to start the box moving is:



a) 98 N **b)** 125 N **c)** 175 N **d)** 56 N **e)** 71 N

9 A car travels around an unbanked highway curve (radius 0.15 km) at a constant speed of 25 m/s. The magnitude of the resultant force acting on the driver, who weighs 0.8 kN is:

a) 0.000 kN **b)** 0.340 kN **c)** 0.255 kN **d)** 0.292 kN **e)** 0.670 kN

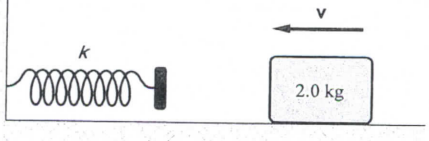
10 A constant force of 15 N in the negative y direction acts on a particle as it moves from the origin to the point $(3\mathbf{i} + 3\mathbf{j} - 1\mathbf{k})$ m. The work done by the given force during this displacement is:

a) + 45 J **b)** – 30 J **c)** + 30 J **d)** – 45 J **e)** – 60 J

11 The force an ideal spring exerts on an object is given by $F_X = -kx$, where x measures the displacement of the object from its equilibrium (x = 0) position. If k = 60 N/m, the work done by this force as the object moves from $x = -0.2\ m$ to x = 0 is:

a) + 1.2 J **b)** – 1.2 J **c)** + 2.7 J **d)** – 2.7 J **e)** + 4.8 J

12 The block is sliding on the frictionless horizontal surface as shown in the figure. The maximum compression caused by the block in the spring (spring constant k = 20 kN/m) is 10 cm. The speed of the block before it touches the spring is:



a) 50 m/s **b)** 10 m/s **c)** 20 m/s **d)** 30 m/s **e)** 40 m/s

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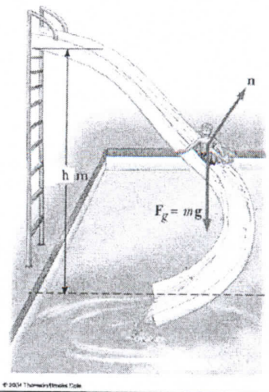
13 A child of mass m (25 kg) rides on an irregularly curved slide of height h (2 m) as shown in the figure. A force of kinetic friction act on the child. The child starts from rest at the top when it reaches to the bottom; his velocity is 4 m/s. The mechanical energy lose by the system is:



a) 290 J
b) 535 J
c) 388 J
d) 168 J
e) 433 J

14 A tennis player receives a shot with the ball (0.06 kg) traveling horizontally at 50 m/s and returns the shot with the ball traveling horizontally at 40 m/s in the opposite direction. the impulse delivered to the ball by the racquet is:

a) 4.5 N.s **b)** 3.6 N.s **c)** 2.1 N.s **d)** 6.8 N.s **e)** 5.4 N.s

15 A 0.1 kg ball is thrown straight up into the air with an initial speed of 16 m/s. The momentum of the ball at halfway up to its maximum height is:

a) 1.1 kg.m/s **b)** 0.85 kg.m/s **c)** 1.4 kg.m/s **d)** 1.9 kg.m/s **e)** 2.4 kg.m/s

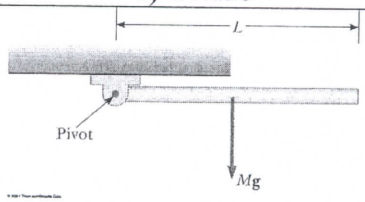
16 A billiard ball moving at 6 m/s strikes a stationary ball of the same mass. After the collision, the first ball moves at 4.33 m/s, at an angle of 30.0° with respect to the original line of motion. Assuming an elastic collision, the struck ball's velocity after the collision is:

a) 2.3 m/s **b)** 1.4 m/s **c)** 3.1 m/s **d)** 4.8 m/s **e)** 5.7 m/s

17 A rotating wheel requires 3 s to rotate through 37 revolutions. Its angular speed at the end of the 3 s interval is 98 rad/s. The angular acceleration of the wheel is:

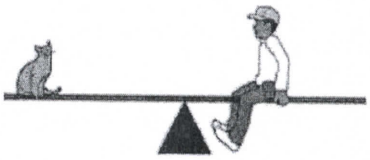
a) 11.7 rad/s^2 **b)** 4.8 rad/s^2 **c)** 16.5 rad/s^2 **d)** 13.7 rad/s^2 **e)** 8.4 rad/s^2

18 A uniform rod of length L= 1 m and mass M, is attached at one end to a frictionless pivot and is free to rotate about the pivot in the vertical plan (as shown in the figure). The rod is released from rest in the horizontal position, the initial angular acceleration of the rod is: *(take $I=\frac{1}{3}ML^2$)*



a) 3.8 rad/s^2 **b)** 14.7 rad/s^2 **c)** 9.8 rad/s^2 **d)** 7.4 rad/s^2 **e)** 17.2 rad/s^2

19 A boy and his cat sit on a seesaw (ارجوحة). The cat has a mass of 2 kg and sits 2 m from the center of rotation. If the boy has a mass of 15 kg, where should he sit so that the seesaw will balance?



a) 0.36 m **b)** 0.44 m **c)** 0.64 m **d)** 0.55 m **e)** 0.27 m

20 Suppose a truck loaded with sand accelerates along a highway. If the driving force on the truck remains constant, what happens to the truck's acceleration if its trailer leaks sand (تسرب المقطورة الرمل) at a constant rate through a hole in its bottom?

a) remains constant **b)** increases **c)** decreases **d)** depends on friction **e)** None of those

21 Which of the following is true?

a) If a car is traveling eastward, its acceleration is eastward
b) If a car is slowing down, its acceleration must be negative
c) A particle with constant acceleration can never stop and stay stopped
d) If a car is traveling westward, its acceleration is westward
e) Non of those

22	_____ measures an object's tendency to resist changing its motion.				
	a) air resistance	**b)** gravity	**c)** reference motion	**d)** friction	**e)** inertia
23	Which of the following cannot possibly be accelerating?				
	a) An object moving with a constant speed	**b)**An object moving with a constant velocity	**c)** An object moving along a curve	**d)** An object moving along a straight line	**e)** Non of those
24	Equal amounts of work are performed on two bodies, A and B, initially at rest, and of masses M and $2M$ respectively. The relation between their speeds immediately after the work has been done on them is:				
	a) $v_A = \sqrt{2}v_B$	**b)** $v_A = 2v_B$	**c)** $v_A = v_B$	**d)** $v_B = \sqrt{2}v_A$	**e)** $v_B = 2v_A$
25	A man of mass (m) climb from the ground on the top of building of height (h) through staircase (سلم) of total length $(\ l\ )$ and come back to the ground by an elevator. The work done by the gravitational force on the man is:				
	a) $-mg(h+l)$	**b)** $+mg(h+l)$	**c)** 0	**d)** $-mgh$	**e)** $+mgh$
26	Two objects have equal kinetic energies. How do the magnitudes of their momenta compare?				
	a) $P_1 < P_2$	**b)** $P_1 = P_2$.	**c)** $P_1 > P_2$	**d)** not enough information to tell	**e)** $P_1 \leq P_2$
27	If you are trying to loosen a stubborn screw from a piece of wood with a screwdriver and fail, should you find a screwdriver for which the handle is:				
	a) longer	**b)** shorter	**c)** fatter	**d)** thinner	**e)** Non of those

The end