First 022 & 023

1- Which of the following is wrong?
Ans : Costant velocity and there is change in acceleration.

2- A book is placed on a chair on the floor, then a video device is placed on top of the book. The ground exerts a vertical force on ..
A - Chair only
B- Book only
C -Video device only
D- It affects the chair, the book, and the video device

3- An object travels north to a point then south to its starting position what is the work done by the friction force ..
A. Zero
B. ukmgd
C. -ukmgd
D. +2ukmgd
E. -2ukmgd

4- If you projectile a ball vertically and it returned to the point of projection, then the work done by the gravity force equals to:
A. zero
B. mgh
C. -mgh

5- What is the average velocity to travel 290 km in 3.25 h.
(in m/s) ...?
Ans: 25.2

6- A car moves in a constant acceleration 1.9 m/s^2 , how long does it take (in seconds) to accelerate from 60 km/h to 120km/h ?

7- If you multiplied a vector by a negative scalar, what statement is always true?
Ans : the magnitude may change, and the direction will be reversed

8- A box was given an initial speed of 6 m/s, and traveled 9 m before getting to rest, what is the coefficient of kinetic friction?

9- A property that causes the body to resist movement or change in direction
A. Velocity
B. Acceleration
C. Inertia

10- A chair is placed on the floor above the chair is a book above the book is an object, which of the following is affected by a Normal force
A. All three
B. Only the object
C. Only the chair
D. On the object upwards and on the chair downward

11- A bird flies at speed 26km/h ,what at what speed (in m/s) does it fly a distance of 2.2km ?

12- A car start moving from rest and then moves 65km/h at t=3s what's the average acceleration in m/s2 ?

13- What is the SI units of work :
A-N.m
B-N/m
C-J/s
D-J.s
E-m

14- What is the SI units of power

A) j/s

B)N/s

C)J.s

D)N.s

E)N.m

15- An object with mass (m) ascends a slope of 25 degrees with speed 14 m/s and reaches a distance 16 m along the incline where it comes to a stop, find the coefficient of kinetic friction.

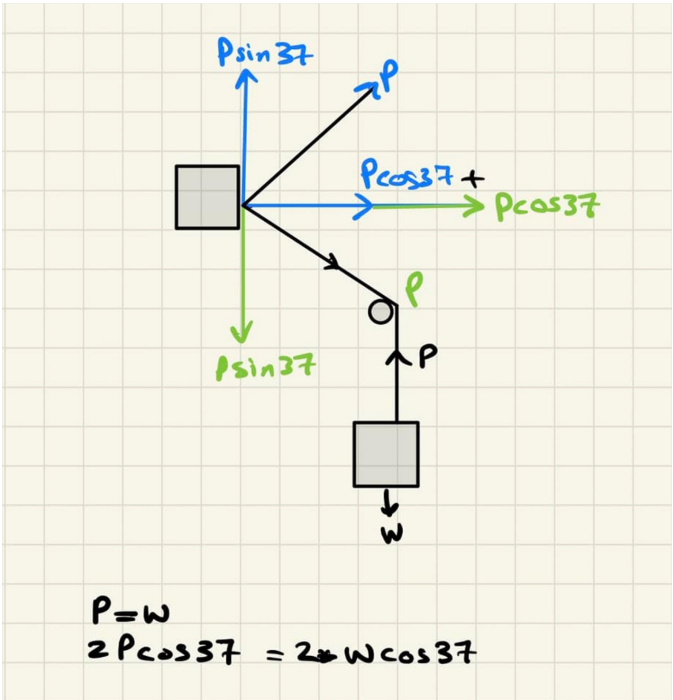
16- Two bodies, the first with a mass M and the second with a mass m, are affected by a force F... If you know that the acceleration of the second is 3 times the acceleration of the first... then the mass of the second body

A-M/3

B-M*3

C-M=m

17 - Find p .



18- There was a question about a body moving at a constant speed and 3 forces acting on it
45 N up , 60N right , Find the third power..

19- A 1.4 kg block is pushed up a frictionless 14° inclined plane from point A to point B which are 1.5 m apart by a horizontal force F. If the kinetic energy at by the force F? point A is 3 J and at point B it is 6 J, how much work is done (in J) on the block

A) 7.2

B) 6.0

C) 8.0

D) 1.0

B)0

20- Two blocks of mass m1= 3.0 kg and mass m2= 14 kg are sitting on the floor of a container as shown. If the container is accelerating downward at 3.5 m/s2 ,the magnitude of the force of block 1 on block 2 (in N) ..

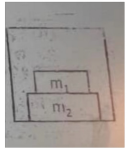
A) 35

B) 29

C) 54

D) 49

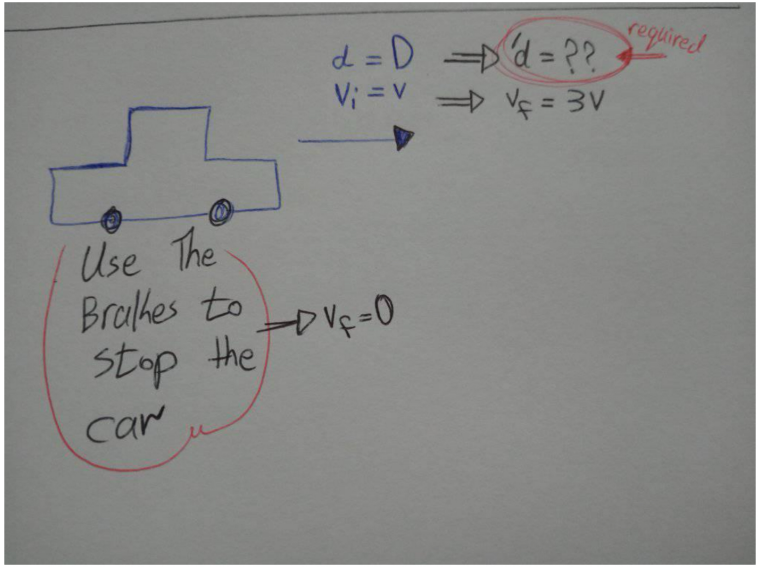
E) 19



21- The position of a particle moving along the x-axis is given by x = 2(t^2)- 1, where t is in seconds.

What is the average velocity during the time interval t = 0 s to t = 2.0 s?

22- find the d' ..



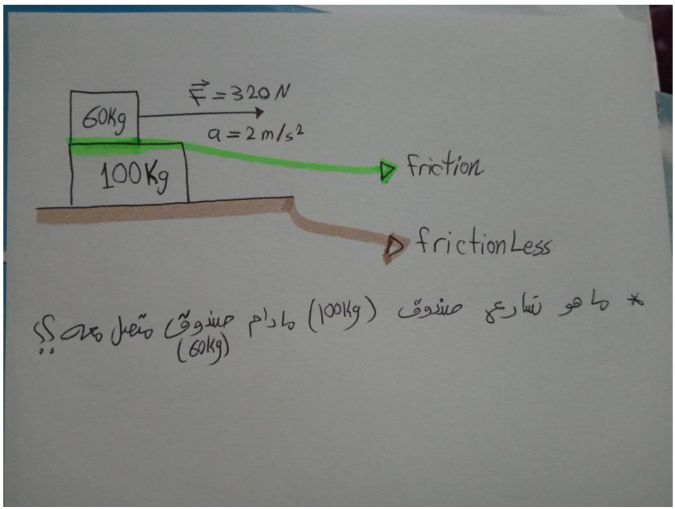
A) 4D

B) 9D

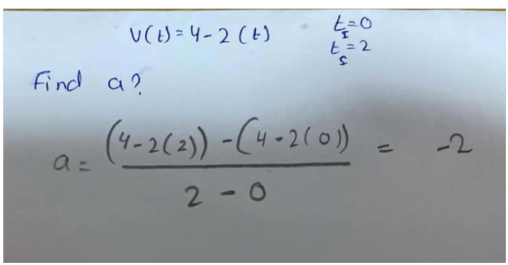
C) 1/2D

D) 1/4D

24- between 100 kg box and surface there is no friction & betwen the two boxes there is friction. Acceleration of 60 Kg box is 2m/s2 , what's Acceleration of 100kg box?



25-



THE UNIVERSITY OF JORDAN | Physics (342105) | PHYSICS DEPARTMENT

Student's Name (Arabic):..... Registration #.....

Lecturer's Name:..... Section # .....

Take $g = 9.8$ m/s^2. **FORM NUMBER 27416** Date: Nov/28/2021

Q1) An object moving along the x-axis has an initial velocity $v = 1$ m/s at t = 0. Its velocity two seconds later is -3 m/s. What is the average acceleration (in m/s^2) of the particle between $t = 0$ and $t = 2$s?

$\vec{a} = \frac{-3-1}{2}$

A) 2 B) 4 C) 0 D) - 2 E) - 4

Q2) A stone is projected vertically upwards from the surface of the ground with an initial speed of 15 m/s. Its average speed (in m/s) over the time interval from its projection to the moment just before hitting the ground is:

A) 7.5 B) 9.8 C) 0 D) 12.5 E) 5.9

$V = \left(\frac{y}{t}\right)_{trip} = \frac{v_i}{2}$

$t_{trip} = \frac{2v_i}{g}$

$y_{trip} = v_i^2/g$

Q3) A car is moving along the positive x-axis at a constant speed of 15 m/s. The driver notices a red traffic light 30 m ahead of him. Thus the driver immediately applies the breaks, and the car decelerates uniformly at 3 m/s^2. Which of the following statements is correct?

A) The car will stop at a position 7.5 m before reaching the traffic light.
B) The car will stop at a position 7.5 m after the traffic light.
C) The car will stop at a position 2.5 m before reaching the traffic light.
D) The car will stop at a position 2.5 m after the traffic light.
E) The car will stop exactly at the position of the traffic light

$v_f^2 = v_i^2 + 2(-a)(\Delta\vec{x})$

$\Delta\vec{x} = \frac{v_i^2}{2a} = +37.5\,m$

Q4) A helicopter is ascending vertically upwards at a constant speed of 12 m/s. When it is at a height of 60 m above the ground it releases a box. The speed (in m/s) of the box just before it hits the ground is:

$v_f^2 = v_i^2 + 2(-a)(-y)$

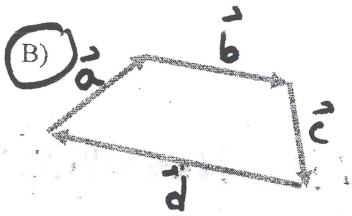
$v_i^2 = (12)^2$

A) 12 B) 34.3 C) 16.7 D) 9.8 E) 36.3

Q5) In each figure, the set of forces act on an object. Which set does NOT change the state of motion of the object?

A)

B)



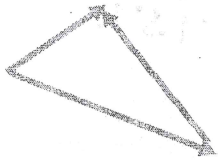
C)

$\vec{a} + \vec{b} + \vec{c} = [-\vec{d}]$

$\Rightarrow$ Net force = zero.

D)

E)



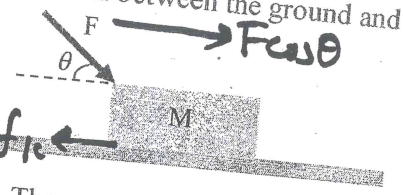
Q6) Which of the following statements is **WRONG**?

A) While mass is a scalar quantity, weight is a vector quantity.
B) The action force and the reaction force can never act on the same object.
C) An object can move at constant velocity if only one force acts on it.
D) If an object is moving at constant velocity, then the resultant force acting on it is zero.
E) The acceleration is always along the direction of the resultant force.

Q7) In the figure the force F = 40 N, M = 4 kg, $\theta = 30^0$ and the coefficient of kinetic friction between the ground and block is $\mu_k = 0.2$. The Acceleration (in m/s^2) of the block is:

A) 0.4
B) 3.5
C) 8.2
D) 9.8
E) 5.7

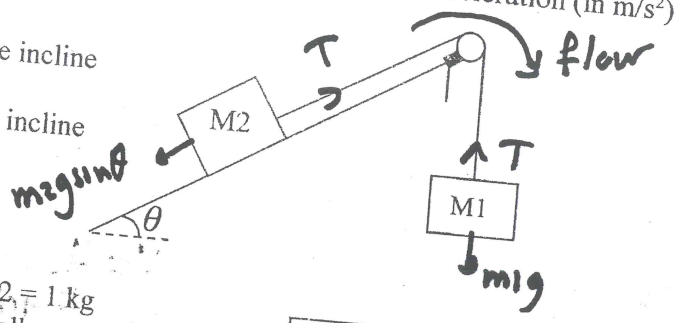
$a = [F\cos\theta - \mu_k(mg + F\sin\theta)]/m$



Q8) In the figure M1 = 3 kg, M2 = 5 kg and $\theta = 30^0$. All the surfaces are frictionless. The acceleration (in m/s^2) of mass M2 is:

A) 0.6 up the incline
B) 0.6 down the incline
C) 2.5 up the incline
D) 2.5 down the incline
E) 0

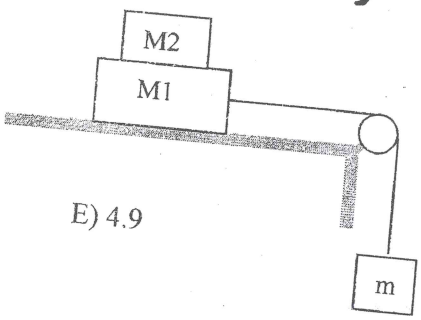
$m_1g - T = +m_1a$
$T - m_2g\sin\theta = +m_2a$



Q9) In the figure, all surfaces are rough. M1=3 kg and M2 = 1 kg and the coefficients of friction $\mu_s = 0.5$ and $\mu_k = 0.2$ for all surfaces. Find the maximum value of mass m (in kg) such that mass M2 will move with mass M1 without sliding. Ignore masses of all strings and the mass of the pulley.

A) 2.8
B) 3.7
C) 4.0
D) 5.6
E) 4.9

$m = \left(\frac{\mu_k + \mu_s}{1 - \mu_s}\right) * (m_1 + m_2)$



Q10) A 12.0-kg child is sitting on the back seat of a car that is moving at a constant velocity of 10 m/s along a horizontal road. The driver notices a red traffic light ahead of him and applies the breaks. If the car comes to a stop in 12 m, calculate the minimum value of the coefficient of static friction such that the child does not slide. (Assume only the force of friction acts on the child in the horizontal direction).

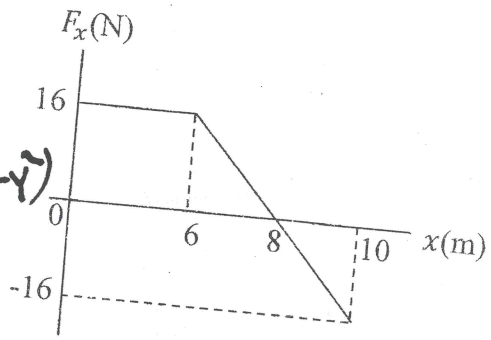
A) 0.4
B) 0.5
C) 0.2
D) 0.7
E) 0.1

$-\mu_s mg = ma$, $v_f^2 = v_i^2 + 2ad$ $\Rightarrow \mu_s = \frac{v_i^2}{2gd}$

Q11) A 4.0-kg object starts moving from the origin with a speed of 2 m/s under the effect of a variable force F_x that acts along the x-axis as shown in the figure. The speed (in m/s) of the object at $x = 10$ m is:

A) 9.8
B) 6.9
C) 7.2
D) 10.0
E) 1.1

$\Delta K = 16*6 = \frac{m}{2}(v_f^2 - v_i^2)$
$v_f = \sqrt{52}$



Q12) You run a race with a friend. At first your kinetic energy is the same as his kinetic energy, but he is running faster than you are. When you increase your speed by 20 percent, you are running at the same speed he is. If your mass is 85 kg, what is his mass (in kg)?

A) 71
B) 59
C) 78
D) 89
E) 67

m_1 m_2

1) $m_1 v_{1i}^2 = m_2 v_{2i}^2$
2) $v_{2i} > v_{1i}$
⇒ Thus we know right off that $m_1 > m_2$.

If $v_{1f} = (1.2)v_{1i} \rightarrow v_{1f} = v_{2i}$

$\therefore m_2 = \left(\frac{v_{1i}}{v_{2i}}\right)^2 m_1$

$m_2 = \left(\frac{v_{1i}}{1.2 v_{1i}}\right)^2 m_1 \rightarrow m_2 = \frac{m_1}{(1.2)^2}$

THE UNIVERSITY OF JORDAN **PHYSICS DEPARTMENT**

PHYSICS 105 (First Exam) **Second Semester**

Student's Name (Arabic):..... Registration #.....

Lecturer's Name:..... Section # .....

CONSIDER (ACCELERATION DUE TO GRAVITY) g = 9.8 m/s^2

Q1) Two objects with masses $M_A = M$ and $M_B = 2M$ are released from rest at the same height h above the ground. Ignoring air resistance, which of the following statements is correct?

A) M_B reaches the ground before M_A.
B) M_A reaches the ground before M_B.
C) M_A and M_B reach the ground at the same time.
D) M_A and M_B have the same speed just before hitting the ground.
E) Answers C and D are correct.

Q2) A car moves along the x - direction such that its position as a function of time is given by $x = t^2 + t - 2$, where x is in meters and t in seconds. The average velocity (in m/s) of the car during the time interval t = 1 to 3 seconds is:

A) 3 B) 10 C) 0 D) 5 E) 3

Q3) A car is moving at a constant velocity v. Upon applying the brakes the car decelerates uniformly and stops after moving a distance D. If the initial velocity is $2v$ the stopping distance becomes:

A) 2D B) 4D C) D D) 6D E) 0.5D

Q4) A stone is thrown vertically upward with a speed of 18 m/s from the edge of a cliff 60 m high. The time (in s) it takes the stone to reach the bottom of the cliff is:

A) 2.1 B) 28.4 C) 18.2 D) 9.6 E) 5.8

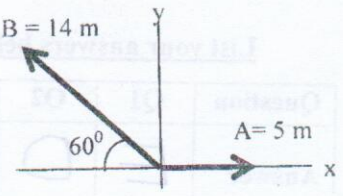
NOT Required

Q5) A man starts from the origin and walks 20 m along the positive x – axis. He then turns around and moves 12 m along the negative x –axis. If the time of the whole trip is 6 s, then his average speed (in m/s) is

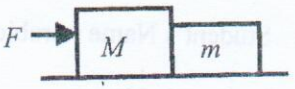
A) 5.3 B) 1.3 C) 3.3 D) 0 E) 2.0

Q6) Vectors A and B are represented as shown in the figure. What is the angle of their resultant $\vec{R} = \vec{A} + \vec{B}$ with respect to the positive x-axis?

A) 44.5° B) 135.5° C) 77°
D) 99.4° E) 112°

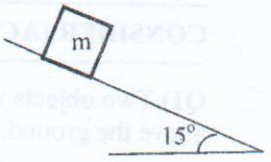


Q7) A block of mass $M = 6.0$ kg is in contact with another block of mass $m = 4.0$ kg on a rough horizontal surface. The coefficient of kinetic friction $\mu_k = 0.2$ and a force $F = 25$ N is applied as shown in the figure. What is the magnitude of the force (in N) of block M on the smaller block m?



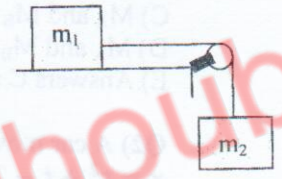
A) 10.0 N B) 16.3 N C) 2.2
D) 25.0 N E) 17.2 N

Q8) In the figure mass m = 2 kg and the coefficients of static and kinetic friction are $\mu_s = 0.4$, $\mu_k = 0.2$ respectively. The acceleration (in m/s^2) of mass m is:



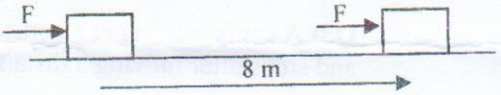
A) 0.64 B) 0 C) 9.8 D) 1.3 E) 2.0

Q9) In the figure the coefficient of kinetic friction between the mass m_1 and the horizontal surface is $\mu_k = 0.10$ and $m_1 = 4.0$ kg, $m_2 = 2.0$ kg. As m_2 moves down, the acceleration of the system (in m/s^2) is:



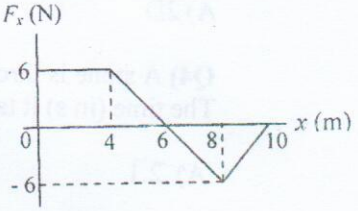
A) 2.6 B) 3.3 C) 9.8 D) 7.8 E) 0

Q10) In the figure, a constant external force $F = 120$ N is applied to a 20-kg box, which is on a rough horizontal surface. The force pushes the box a distance of 8.0 m, in a time interval of 4.0 s, and the speed changes from $v_i = 0$ to $v_f = 3$ m/s. The work done (in J) by the force of friction is



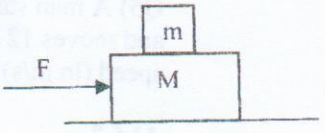
A) +960 B) +870 C) −90
D) −960 E) −870

Q11) The figure shows the force F_x that acts on a 2 kg mass moving along the x-axis. The mass starts from the origin with an initial velocity of 3 m/s. Its final speed (in m/s) at $x = 10$ m is:



A) 7.1 B) 4.2 C) 0
D) 5.2 E) 6.1

Q12) In the figure shown the horizontal surface is frictionless and M = 4 kg, m = 2 kg. If the coefficients of static and kinetic friction between the surfaces of blocks m and M are $\mu_s = 0.4$ $\mu_k = 0.2$, then the maximum allowed value of the force F (in N) such that block m does **not slide** is:



A) 11.8 B) 3.9 C) 7.8 D) 23.5 E) 47.0

List your answers below IN CAPITAL LETTER. ONLY answers in this table will be graded

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Answer	E	D	B	E	A	D	A	B	A	E	D	D

The University of Jordan / Physics Dept.
First Exam Solutions / Physics for Medical Students (105)
Solutions by Prof. Mahmoud Jaghoub / 12/3/2018

Q1] Both masses started from rest at the same height and the have the same gravitational acceleration $\Rightarrow$ the reach the ground at the same time with the same velocity.

Q2] $\bar{v}_{1-3} = \dfrac{[9+3-2]-[1+1-2]}{3-1} = 5$ m/s

Q3] $v_f^2 - v_i^2 = 2a\Delta x \Rightarrow 0 - v_i^2 = -2|a|\Delta x$ ← for deceleration.

$\therefore \Delta x = \dfrac{v_i^2}{2|a|} = D$

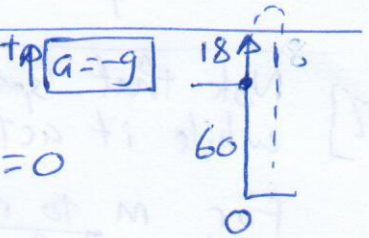
$v_i \to 2v_i \Rightarrow \Delta x' = \dfrac{(2v_i)^2}{2|a|} = 4\dfrac{v_i^2}{2|a|} = 4D$

Q4] $y_f - y_i = v_i t - \frac{1}{2}gt^2$

$-60 = 18t - 4.9t^2 \Rightarrow 4.9t^2 - 18t - 60 = 0$

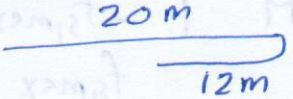
$t = \dfrac{18 \pm \sqrt{(18)^2 - 4(4.9)(-60)}}{2\times 4.9} \Rightarrow t \sim 5.8$ s

(ignore negative answer)



Q5] total distance $= 20 + 12 = 32$ m.

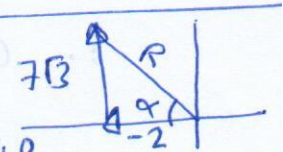
$\bar{s} = \dfrac{\text{total distance}}{\text{total time}} = \dfrac{32}{} \simeq 5.3$ m/s



Q6] $A_x = 5$, $A_y = 0$ | $B_x = -14\cos 60 = -7$, $B_y = 14\sin 60 = 7\sqrt{3}$ | $R_x = -2$, $R_y = 7\sqrt{3}$ | $\tan\alpha = \left|\dfrac{7\sqrt{3}}{-2}\right|$

$\Rightarrow \alpha = 80.6$

$\Rightarrow \theta = 180 - \alpha = 99.4^\circ$



Q7] $\rightarrow +$ $F - P - f_{Mk} = Ma$ — ①

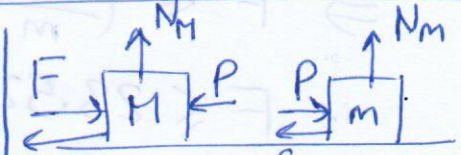
$P - f_{mk} = ma$ — ②

$F - f_{mk} - f_{Mk} = ma \Rightarrow 25 - M_k 6g - M_k 4g = 10a$

$\Rightarrow 25 - 19.6 = 10a \Rightarrow a = 0.54$ m/s^2

using ② $P = M_k(4g) + 4a$

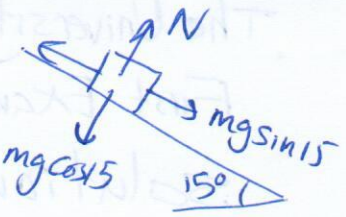
$P = 10$ Newtons



Q8] $f_{s,max} = \mu_s(mg\cos 15) \simeq 7.57$ Newton

$mg\sin 15 \simeq 5.07$

$f_{s,max} > mg\sin 15 \Rightarrow$ object does NOT move $\Rightarrow a = 0$

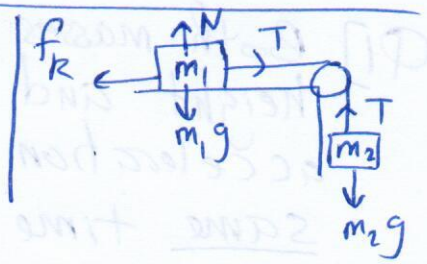


Q9] $\downarrow$ for m_2 $\quad m_2g - T = m_2a$

$\rightarrow$ for m_1 $\quad T - f_k = m_1a$

$\Rightarrow m_2g - f_k = (m_1+m_2)a$

$$a = \frac{m_2g - \mu_k(m_1g)}{m_1+m_2} \simeq 2.6 \text{ m/s}^2$$



Q10] $\Delta K + \Delta U = W_{nc}$ F and F_k are non-conservative forces

$\frac{1}{2}(20)(9-0) + 0 = W_F + W_{f_k} = (120)(8)\cos(0) + W_{f_k}$

$90 = 960 + W_{f_k} \Rightarrow W_{f_k} = 90 - 960 = -870$ J.

Q11] $\Delta K = W_{Total}$ = Area under $F_x - x$ graph.

$\frac{1}{2}(2)(v_f^2 - 9) = 4\times 6 + \frac{1}{2}(2)(6) + \frac{1}{2}(2)(-6) + \frac{1}{2}(2)(-6)$

$v_f^2 - 9 = 24 + 6 - 6 - 6 = 18 \Rightarrow v_f = \sqrt{27} \sim 5.2$ m/s

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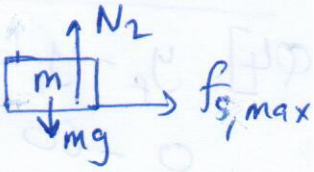
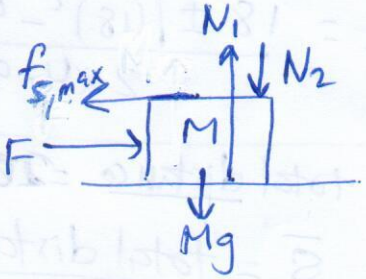
Q12] Note that $f_{s,max}$ acts on m to the right while it acts on M to the left.



For m to move with M without sliding $\boxed{f_{s,max} \geq ma} \Rightarrow a \leq \frac{f_{s,max}}{m}$



$\rightarrow$ + for M $\quad F - f_{s,max} = Ma$ — ①

$f_{s,max} = ma$ — ②

$F = (m+M)a$

$\therefore a = \frac{F}{m+M} \leq \frac{f_{s,max}}{m}$

$\Rightarrow F \leq \left(\frac{m+M}{m}\right) f_{s,max} = \left(\frac{2+4}{2}\right)(\mu_s mg) = \left(\frac{6}{2}\right)(0.4\times 2\times 9.8)$

$\therefore F \leq 23.52$

$\Rightarrow$ max. value for F is 23.52 Newton.

THE UNIVERSITY OF JORDAN **PHYSICS DEPARTMENT**

PHYSICS 105 (First Exam) **First Semester**

Student's Name (Arabic):..... Registration #.....

Lecturer's Name:..... Section # .....

***CONSIDER (ACCELERATION DUE TO GRAVITY) g = 9.8 m/s^2**

Q1) The position of an object (in m) is given as a function of time (in s) as $x(t) = (3.0)t + (2.0)t^2$. What is the average velocity of the object (in m/s) between $t = 0.0$ s and $t = 3.0$ s?

A) 7.0 B) 13 C) 27 D) 9.0 E) 3.0

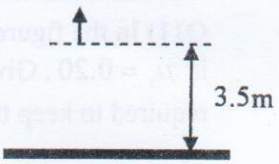
Q2) A stone is thrown vertically upwards reaches a highest point and returns to the ground. When the stone is at the top of its path, its acceleration

A) changes direction from upwards to downwards.
B) is zero.
C) is directed upwards.
D) is directed downwards.
E) none of the above.

Q3) A car starting from rest travels a distance of 20.0 m with an acceleration of 2.0 m/s^2. The car then slows to a stop uniformly in 5.00 seconds. The distance traveled by the car during the whole time period (in m) is:

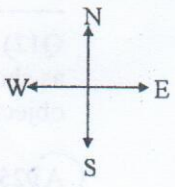
A) 36.8 B) 42.4 C) 50.1 D) 58.3 E) 64.7

Q4) A ball is thrown vertically upwards with a speed of 12 m/s. If the ball starts at an initial height of 3.5 m, how long (in s) the ball is in the air?



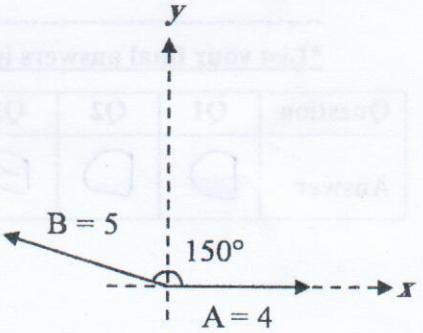
A) 3.3 B) 1.5 C) 6.6
D) 2.7 E) 0.41

Q5) A car starts from the origin and drives 2.2 km south, then 3.1 km in a direction 53° north of east. What is the car's final position relative to the origin?



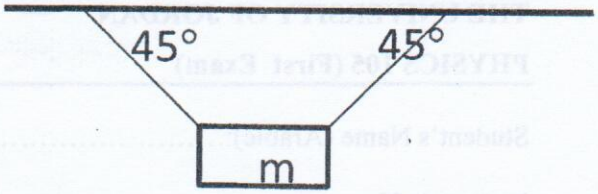
A) 1.9 km east
B) 3.1 km east and 1.2 km south
C) 1.9 km east and 1.3 km north
D) 1.9 km east and 2.5 km north
E) 1.9 km east and 0.3 km north

Q6) Vectors **A** and **B** are represented as shown in the figure. What is the angle of their resultant with respect to the positive x-axis?



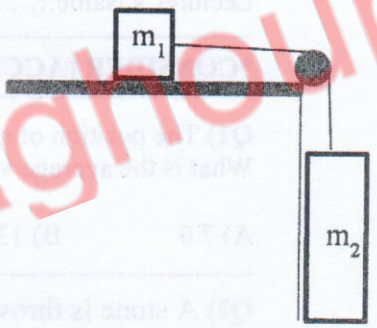
A) −77° B) −82° C) 283°
D) 103° E) 98°

Q7) A box of mass M = 50 kg is suspended by two massless cables as shown below. Find the tension in the cable on the left.



A) 740 B) zero
C) 346 D) 520 E) 75

Q8) Two blocks are connected by a massless string which runs over a massless pulley as shown in the figure. The coefficient of kinetic friction between the mass m_1 and the horizontal surface is $\mu_k = 0.40$ and $m_1 = 3.0$ kg, $m_2 = 9.0$ kg. The acceleration of the system (in m/s^2) is:

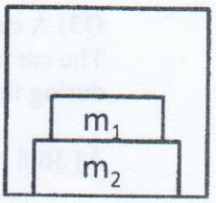


A) 6.4 B) 32 C) 9.8
D) 4.9 E) 140

Q9) A block of mass 0.52 kg is sliding on a rough horizontal surface. If the block has an initial speed of 60 m/s, and slides a distance of 2200 m before coming to rest, the work done by friction (in J) is:

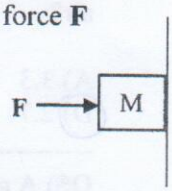
A) −36 B) −14 C) −936 D) − 414 E) −122

Q10) Two blocks of mass $m_1 = 3.0$ kg and mass $m_2 = 14$ kg are sitting on the floor of a container as shown. If the container is accelerating downward at 3.5 m/s^2, the magnitude of the force of block 1 on block 2 (in N) is:



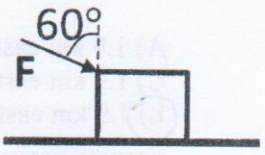
A) 19 B) 29 C) 49
D) 35 E) 54

Q11) In the figure shown, the coefficient of static friction between the mass M and the vertical wall is $\mu_s = 0.20$. Given that M = 4.0 kg, determine the minimum value of the horizontal force **F** required to keep the mass M stationary.



A) 98 B) 20 C) 196
D) 47 E) 0.0

Q12) A force **F** of 50 N is applied to a box of mass 5 kg moving on the floor as shown in the diagram. How much work (in J) is done by this force as the object moves 60 m?



A) 2598 B) 5196 C) 3000
D) 1500 E) 8042

***List your final answers in this table. Only the answer in this table will be graded**

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Answer	D	D	B	D	E	E	C	A	C	A	C	A

Physics (0342105)/First Exam
30th OCT/2017
Sample Solutions / Prof. Mahmoud Jaghoub

Q1] $\bar{v}_{0-3} = \frac{x_f - x_i}{t_f - t_i} = \frac{x(3)-x(0)}{3-0} = \frac{27-0}{3} = 9$ m/s

---

Q2] D) acceleration is directed downwards.

Note: Gravitational acceleration is always towards the center of the earth (downwards) independent of the direction of motion.

Q3] $\Delta x_1 = 20$ m, $a = 2$ m/s^2 in first phase of motion, $v_{1i} = 0$

$\Delta x_2 = ?$ in second phase of motion, $t = 5$ s.

Note: we have two different phases of motion.

phase 1: $v_{1f}^2 - v_{1i}^2 = 2a\Delta x_1 \Rightarrow v_{1f} = \sqrt{2\times2\times20} = 4\sqrt{5}$ m/s

phase 2: $\Delta x_2 = \frac{1}{2}(v_{2i} + v_{2f})t$

Note: $v_{2i} = v_{1f} = 4\sqrt{5}$ m/s, $v_{2f} = 0$

$\Rightarrow \Delta x_2 = \frac{1}{2}(4\sqrt{5} + 0)(5) \simeq 22.4$ m

$\Rightarrow$ Total displacement $\Delta x = \Delta x_1 + \Delta x_2 = 20 + 22.4 = 42.4$ m

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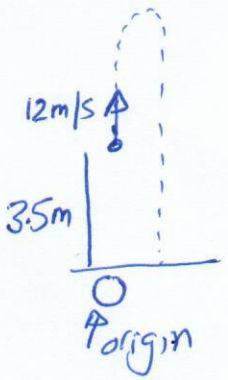
Q4] $\boxed{a = -g}$



$y_f - y_i = v_i t - \frac{1}{2}gt^2$

$0 - 3.5 = 12t - 4.9t^2$

$4.9t^2 - 12t - 3.5 = 0$

$t = \frac{12 \pm \sqrt{(-12)^2 - 4(4.9)(-3.5)}}{2(4.9)}$

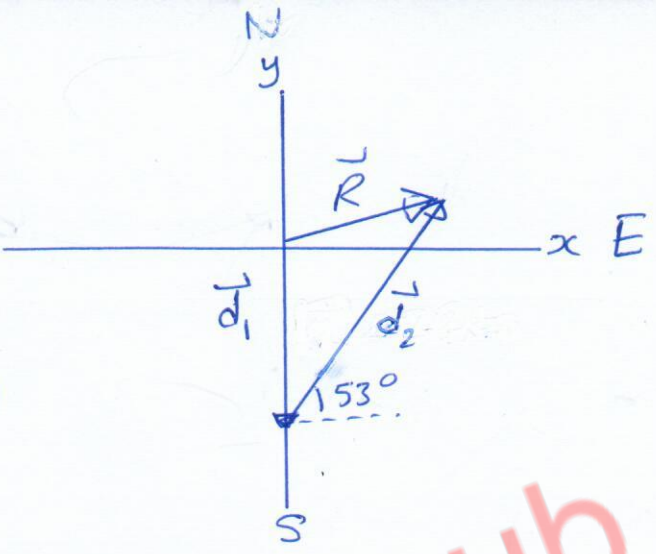
$t \simeq 2.7$ s.

Q5] Resolve both displacements into components.

$d_{1x} = 0$, $d_{1y} = -2.2$ km (North)

$d_{2x} = 3.1 \cos 53^\circ \simeq 1.9$ km (East)

$d_{2y} = 3.1 \sin 53^\circ \simeq 2.5$ km (North)



$\therefore \vec{R} = \vec{d}_1 + \vec{d}_2$

$R_x = 1.9$ km (East)

$R_y = 0.3$ km (North)

Q6] $\vec{R} = \vec{A} + \vec{B}$

$R_x = A_x + B_x$, $R_y = A_y + B_y$

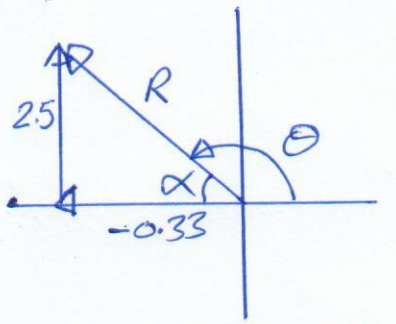
$A_x = 4$, $A_y = 0$

$B_x = 5 \cos 150^\circ = -5 \cos 30^\circ = -2.5\sqrt{3}$

$B_y = 5 \sin 150^\circ = 5 \sin 30^\circ = 2.5$

$\Rightarrow R_x = 4 - 2.5\sqrt{3} \simeq -0.33$

$R_y = 2.5$



$\tan\alpha = \left| \frac{2.5}{-0.33} \right| = \frac{2.5}{0.33}$

$\therefore \alpha \simeq 82.4^\circ$

$\Rightarrow \theta = 180^\circ - \alpha \simeq 98^\circ$

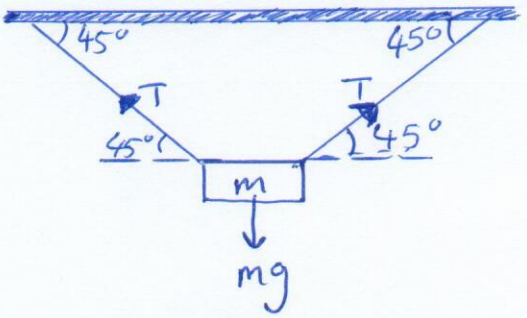
Q7] since angles are equal
$\Rightarrow$ tensions are equal in magnitude.

Resolve horizontally and vertically

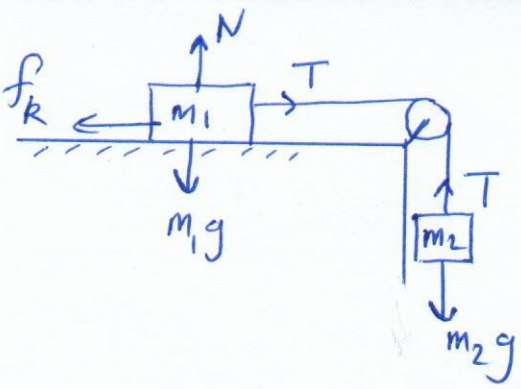
$T \sin 45 + T \sin 45 = mg$

$2T \sin 45 = mg$

$T = \frac{mg}{2 \sin 45} \simeq 346$ Newton.



Q8]



For m_2: $\downarrow +$ $m_2 g - T = m_2 a$ — (1)

for m_1: $\rightarrow +$ $T - f_k = m_1 a$ — (2)

(1)+(2) $\Rightarrow$ $m_2 g - f_k = (m_1 + m_2) a$

$m_2 g - \mu_k (m_1 g) = (m_1 + m_2) a$

$$a = \frac{m_2 g - \mu_k (m_1 g)}{m_1 + m_2} \simeq 6.4 \ m/s^2$$

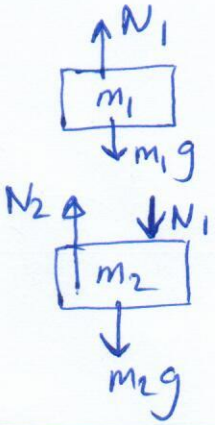
Q9] $W_{Total} = \Delta K = \frac{1}{2}(0.52)(0 - (60)^2) = -936$ J.

Q10] $m_1 = 3kg$, $m_2 = 14$ kg

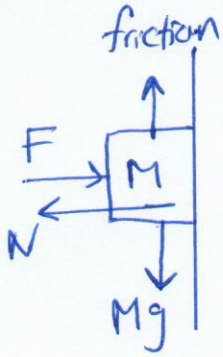
For m_1:

$\downarrow +$ $m_1 g - N_1 = m_1 a$

$N_1 = m_1 g - m_1 a = m_1 (g - a) \simeq 18.9$ Newton $\simeq 19$ Newton



Q11] maximum possible value of friction is $f_{s,max}$ for block to remain stationary $\Rightarrow$ Mg must NOT exceed $f_{s,max}$.



$\therefore f_{s,max} \geq Mg$ for block to remain stationary

$\mu_s N \geq Mg \Rightarrow \mu_s (F) \geq Mg$

$$\therefore F \geq \frac{Mg}{\mu_s} \Rightarrow F \geq \frac{4 \times 9.8}{0.2} \Rightarrow F_{min} = 196 \text{ Newton}$$

Q12] $W = (F \sin 60)(60)$

$\simeq 2598$ J.