2.5/30

The University of Jordan | **Department of Physics**

General Physics 101 | **Second Exam** | **(10:00 – 11:00) am** | **2/12/2017**

الاسم: ---------------------------- الرقم الجامعي: ---------

إسم الدكتور: ------------------- رقم الشعبة أو وقت المحاضرة: ------

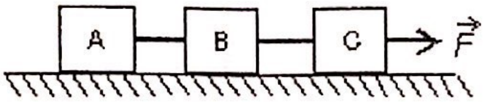
Consider g = 9.8 m/s^2

Question	1	2	3	4	5	6	7	8	9	10	11	12
Answer	a	b	c	d	e	e	d	b	a	c	b	e

1. An applied force of 10 N compresses (يضغط) a spring with a 20-N/m spring constant. The work done (in J) by this force is:

A) 0.5 B) 2.5 C) 5 D) 10 E) 200

2. Three blocks (A, B, C), each having the same mass M, are connected by strings as shown. Block C is pulled to the right by a force $\vec{F}$ that causes the entire system to accelerate. Neglecting friction, the net force acting on block B is:



A) 0 B) $\vec{F}/3$ C) $\vec{F}/2$ D) $2\vec{F}/3$ E) $\vec{F}$

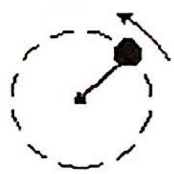
3. A constant force (50-N) acts on a 2-kg box that starts from rest. When the force has been acting for 2 s the rate at which it is doing work (in W) is:

A) 100 B) 1000 C) 2500 D) 5000 E) 63000

4. Let M denote the mass of Earth and let R denote its radius. The ratio g/G at Earth's surface is:

A) R^2/M B) M/R C) MR^2 D) M/R^2 E) R/M

5. The ball shown is being swung (يتأرجح) in a vertical circle at the end of a 0.7-m string. The minimum speed (in m/s) needed for the ball to pass successfully over the top position is:



A) 1.3 B) 9.8 C) 3.9 D) 6.9 E) 2.6

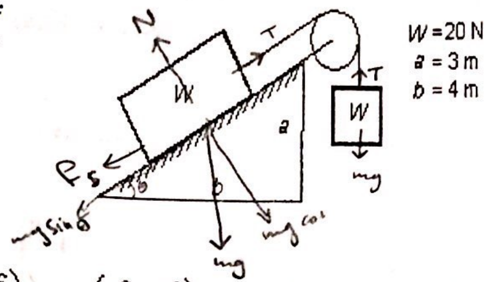
6. A 40-N box rests on a rough (خشن) horizontal floor. A 12-N horizontal force is then applied to it. If the coefficients of friction are $\mu_s = 0.5$ and $\mu_k = 0.4$, the magnitude of the frictional force on the box (in N) is:

A) 8 B) 40 C) 16 D) 20 E) 12

7. The energy transferred to a system as a function of time is equal to: [$E(t) = 3.5\,t + 6.2\,t^2$, (in J)]. The time rate of this energy (in W) at $t = 3.1$ s is:

A) 3.5 B) 6.2 C) 16 D) 42 E) 70

8. The system shown remains at rest. The force of friction (in N) on the block on the incline is:



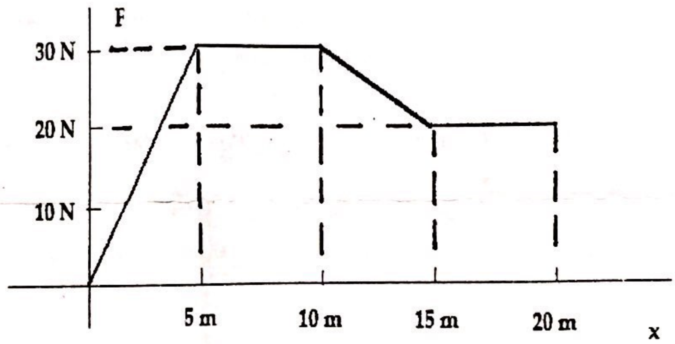
A) 4 B) 8 C) 12

D) 16 E) 20

9. As a 2.0-kg object moves from $(2\hat{i} + 5\hat{j})$ m to $(6\hat{i} - 2\hat{j})$ m, the constant resultant force acting on it is equal to $(4\hat{i} - 3\hat{j})$ N. If the speed of the object at the initial position is 4.0 m/s, its kinetic energy (in J) at the final position is:

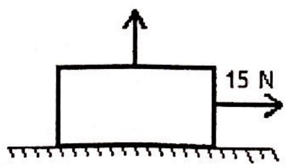
A) 53 B) 62 C) 73 D) 86 E) 24

10. The plot below shows the force on an object as it moves along the x axis. The work (in J) done on the object as it moves from $x = 0$ m to $x = 20$ m is:



A) 40 B) 90 C) 450 D) 200 E) 750

11. A box with a weight of 50 N rests on a horizontal surface. A person pulls horizontally on it with a force of 15 N and it does not move. To start it moving, a second person pulls vertically upward on the box. If the coefficient of static friction is 0.4, the smallest vertical force (in N) for which the box moves is:



A) 12.5 B) 5.5 C) 20.5 D) 25.5 E) 35.5

12. A 0.50-kg object moves on a horizontal frictionless circular track with a radius of 2.5 m. An external constant force of 3.0 N, always tangent to the track, causes the object to speed up as it goes around. If the object starts from rest, then at the end of one revolution (دورة) the radial component of the force (in N) of the track on it is:

A) 19 B) 96 C) 47 D) 75 E) 38

Fall 2017

1) $F_{app} = K\Delta x$, $x_i = 0$

$10 = 20 x_f$

$x_f = 0.5\,m$

$W = \frac{1}{2} K (x_f^2 - x_i^2)$

$W = \frac{1}{2} (20)(0.5)^2$

$W = 2.5\,J$

B) 2.5

2) $\vec{F} = 3M\vec{a}$

$a = \frac{F}{3M}$

$F_B = M \frac{F}{3M}$

$\vec{F}_B = \frac{\vec{F}}{3}$

B) $\vec{F}/3$

3) $F = ma$

$50 = 2a$

$a = 25\,m/s^2$

$v_2 = v_1 + at$

$v_2 = 25(2)$

$v_2 = 50\,m/s$

$P = Fv$

$= (50)(50)$

$P = 2500\,W$

c) 2500

4) $g = \frac{GM}{R^2}$

$\frac{g}{G} = \frac{M}{R^2}$ D) M/R^2

---

5) $V = \sqrt{rg}$

$= \sqrt{(0.7)(10)}$

$V = 2.64$ E) 2.6

---

6) $f_s = N\mu_s$ $f_s = F$

$= 40(0.5)$ $f_s = 12\ N$

$f_{s_{max}} = 20$ E) 12 N

---

7) $P = \frac{dw}{dt}$

$P = 3.5 + 12.4t$

$P @ t=3 = 41.94$ D) 42

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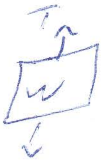
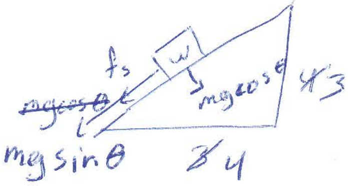
8) 

$mg = 20$



$T = f_s + mg\sin\theta$

$20 = f_s + 12$

$f_s = 8N$

$T - 20 = 0$

$T = 20N$

$\tan^{-1}\left(\frac{3}{4}\right) = 37°$

B) 8

9) $\vec{d} = (6-2)\hat{i} + (-2-5)\hat{j}$

$\vec{d} = 4\hat{i} - 7\hat{j}$

$W = \vec{F} \cdot \vec{d}$

$W = 37 J$

$W = \Delta KE$

$37 = KE_2 - \frac{1}{2}(2)(4)^2$

$KE_2 = 53 J$

A) 53

---

10) calculate the Area

C) 450

---

11) $15 \geq 0.4 N$

$N = 37.5$

$50 - 37.5 = 12.5$

A) 12.5

---

12) $F_t = a_t m$

$a_t = 6 m/s^2$

$v_2^2 = v_1^2 + 2a_t(2\pi(2.5))$

$v_2^2 = 60\pi$

$F_r = \frac{v^2 m}{r}$

$= 12\pi$

$F_r = 37.7$

E) 38

اسم مدرس المادة:

الرقم المتسلسل :   وقت المحاضرة:

22/30

The University of Jordan
Faculty of Science
Physics Department

General Physics (0302101)
Second Exam
Second Semester 2017/2018

Name (in Arabic): Student ID: Section:

(Exam duration: 75 minutes)

Note 1: Following are 15 multiple-choice questions. Write the symbol of correct answer in the answers table. *Only* the answers in the table will be graded.
Note 2: Ignore air resistance in all problems and take $|g| = 9.8$ m/s^2 at the Earth's surface.

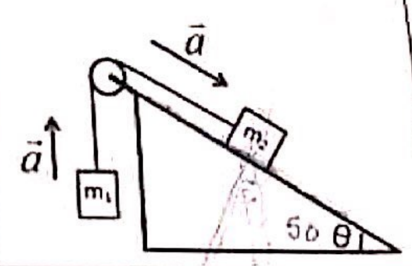
Answers table

Question number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Symbol of correct answer	d	e	e	b	a	b	b	d	d	a	c	a	d	e	b

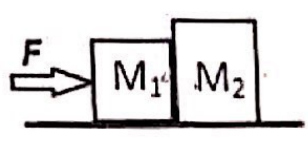
Q.1: The only three forces that act on a 3-kg particle are as follows: $\vec{F}_1 = (2\hat{i} + 3\hat{j})N$, $\vec{F}_2 = (\hat{i} + 2\hat{j})N$ and $\vec{F}_3 = (2\hat{i} + 5\hat{k})N$. The magnitude (in m/s^2) of the particle's acceleration is:
a. 9.80 b. 4.33 c. 12.12 d. 2.89 e. 20.46

Q.2: A force $\vec{F} = (6\hat{i} - 2\hat{j})N$ acts on a particle that undergoes a displacement $\Delta\vec{r} = (3\hat{i} - \hat{j})m$. The work (in Joules) done by this force on the particle is:
a. 11 b. 14 c. 16 d. 18 e. 20

Q.3: A 2-kg hanging mass (m_1) is connected by a string over a pulley to a 20-kg block (m_2) that is sliding on a 50^0 fixed inclined plane (see the adjacent figure). If the pulley's mass and the mass of the string are negligible, and all surfaces are frictionless, the magnitude of the acceleration (in m/s^2) of the moving system is:
a. 2.56 b. 9.80 c. 0.21
d. 1.15 e. 5.93

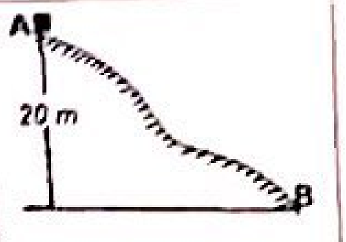


Q.4: Two blocks M_1 = 3 kg and M_2 = 5 kg are in contact with each other on a frictionless, horizontal surface, as shown in the adjacent figure.
If a horizontal force F = 16 N is applied to M_1, the magnitude (in N) of the contact force between the two blocks is:
a. 2 b. 4 c. 7 d. 10 e. Zero



Q.5: An object of mass m, speed V and initial kinetic energy K_i. If the speed of the object becomes 3V, then the ratio (K_f/K_i) is:
a. 9 b. (1/9) c. 1 d. 18 e. 81

Q.6: A 50-kg object slides from rest from point A on the rough track shown in the adjacent figure. If the speed of the particle at point B is 6 m/s. The work (in J) done by frictional forces is:

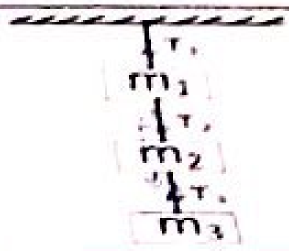


a. -7300 b. -8900 c. -3700
d. -4000 e. -5300

Q.7: A ball of mass 2 kg is fired straight up with an initial speed of 20 m/s. It rises to its maximum height, and then falls down to its starting point. Neglecting air resistance, the work (in J) done on the ball by gravitational force through the entire trip is:

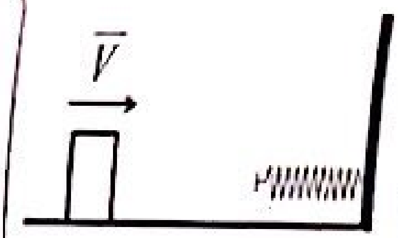
a. -22.8 b. 18.6 c. Zero d. 22.8 e. -18.6

Q.8: The adjacent figure shows a setup of three masses that are connected by three wires. The whole system is under static equilibrium. If m_1 = 15 kg, m_2 = 25 kg and m_3 = 60 kg. The tension (T_1) in the first wire (measured in Newtons) is:



a. 680 b. 588 c. 196 d. 980 e. 294

Q.9: The adjacent figure shows a box of mass 3 kg moving on a horizontal, frictionless surface with a speed of 4 m/s towards an unstretched spring of negligible mass that is attached horizontally to a rigid wall. The box collides with the spring and stops momentarily before reversing direction. If the spring constant is 1000 N/m, the maximum compression (in m) of the spring is:



a. 0.550 b. 0.219 c. 0.357
d. 0.179 e. 0.742

Q.10: True or False:
"The work done by any conservative force on a particle moving through any closed path is zero"

a) True b. False

Q.11: A box with initial speed V_i = 5 m/s slides on a rough horizontal surface. If the coefficient of kinetic friction is 0.8, the distance (in m) moved by the box before coming to a stop is:

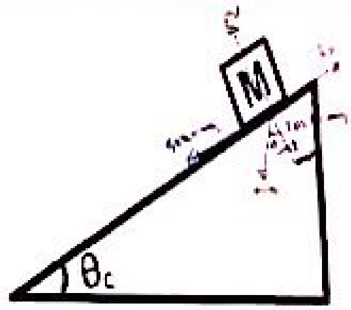
a. 0.56 b. 2.34 c. 1.59 d. 3.14 e. 8.43

Q.12: A potential energy function for a two-dimensional force is of the form:
$U(x, y) = (3x^2y - 7x)$ J. The magnitude of the force (in N) that acts at the point (1, 2) m is:

a. 5.83 b. 3.77 c. 9.80 d. 12.65 e. 25.41

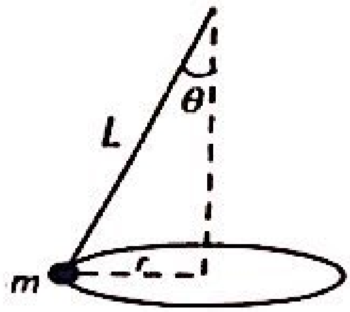
$6xy - 7$
$5i$
$3x^2$
$3 \cdot 1 - 3$

Q.13: A block of mass M rests on an inclined rough surface. The inclination angle of the surface is increased to θ_c at which point the block becomes on the verge of slipping. The coefficient of static friction of the surface is:



a. $\sin(\theta_c)$ b. $\cos(2\theta_c)$ c. $\sin(4\theta_c)$
d. $\tan(\theta_c)$ e. $\sin^2(\theta_c)$

Q.14: A small ball of mass m is suspended from a string of length L. The ball revolves with constant speed v in the horizontal circle of radius r as shown in the adjacent figure. If the string makes an angle θ with the vertical direction, the speed v of the ball is given by:



a. $\sqrt{rg \sin\theta}$ b. $\sqrt{rg \cos\theta}$
c. $\sqrt{rg \csc\theta}$ d. $\sqrt{rg \cot\theta}$
e. $\sqrt{rg \tan\theta}$

Q.15: A force $\vec{F} = (8\hat{i} + 3\hat{j})$ N acts on a box that is sliding on a floor. At the instant the velocity of the box is $\vec{V} = (3\hat{i} - 2\hat{j})$ m/s, the instantaneous power (in Watts) supplied by this force is:

a. 30 b. 18 c. 11 d. 55 e. 78

Good Luck!!!

Spring 17/18

1) $\vec{F}_{eq} = 5\hat{i} + 5\hat{j} + 5\hat{k}$

$|F| = \sqrt{75}$

$F = ma$

$a = \frac{\sqrt{75}}{3}$

$a = 2.88$

D) 2.89

---

2) $W = \vec{F} \cdot \vec{d}$

$(6)(3) + (-2)(-1) = 20$

E) 20

---

3) $T - mg = 2a$

$T - 20 = 2a$ ---- ①

$200\sin(50) - T = 20a$

$153.2 - T = 20a$

mode → EQN → 1

$T = 32.1$ $a = 6.05$

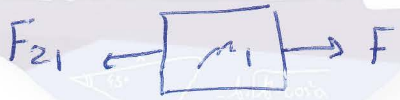
E) 5.93

---

4) $F = ma$

$16 = (5+3)\,a$

$a = 2\,m/s^2$



$F - F_{21} = m_1 a$

$16 - F_{21} = 6$

$F_{21} = 10\,N$

D) 10

---

5) $K_i = \frac{1}{2} m v^2$

$K_f = \frac{1}{2} m (3v)^2$

$= \frac{1}{2} m\, 9v^2$

$\frac{K_f}{K_i} = \frac{\frac{1}{2} m\, 9 v^2}{\frac{1}{2} m\, v^2} = 9$

A) 9

6) $mgh_A - f_K d = \frac{1}{2} m v_f^2$

$g = 9.8\ m/s^2$

$W_{fK} = - f_K d$

~~10,000 - W_{fK} =~~

$9800 + W_{fK} = 900$

$W_{fK} = -8900$

B) -8900

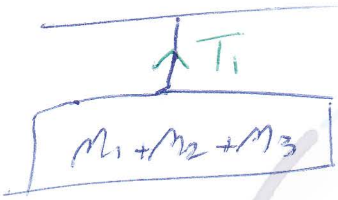
---

7) falls down to it's starting point → W_g = zero

C) zero

---

8)



$T - 100(g) = 0$

$T = 980$

D) 980

---

9) $\frac{1}{2} m v_i^2 = \frac{1}{2} k x_f^2$

$x_f = 0.219$

$48 = 1000\, x_f^2$

B) 0.219

$x_f^2 = 0.048$

---

10) TRUE

A) True

---

11) $\frac{1}{2} m v_i^2 = (mg)(0.8)(d)$

$\frac{1}{2} m v_i^2 - f_K d = 0$

$d = \frac{(1/2)(25)}{(0.8)(9.8)} = 1.594$

C) 1.59

12) $\frac{\partial U}{\partial x} = -(6xy - 7)$ $\qquad \vec{F} = (6xy-7)\hat{i} + (3x^2)\hat{j}$

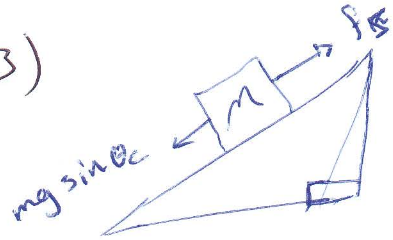
$\frac{\partial U}{\partial y} = -(3x^2)$ $\qquad \vec{F} = (-5\hat{i}) + (-3\hat{j})$

$|F| = 5.83$

A) 5.83

---

13)



$f_s = N\mu_s$

$f_s = mg\cos\theta_c\,\mu_s$

$mg\sin\theta_c = mg\cos\theta_c\,\mu_s$

$\mu_s = \tan\theta_c$

D) $\tan\theta_c$

---

14) $v = \sqrt{rg\tan\theta}$

E) $\sqrt{rg\tan\theta}$

*check page "68" from Omar AbdulAal notebook

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15) $P_{inst} = \vec{F} \cdot \vec{v}$

$= (8)(3) + (3)(-2)$

$= 18$ watts

B) 18

22/30

اسم مدرس المادة:

رقم الشعبة: ٢٠ الرقم المتسلسل: 21

The University of Jordan
Faculty of Science
Physics Department

General Physics (1) (0302101)
Second Exam
First Semester 2016/2017

- **Student's Name:**...علاء سمير يوسف عكاوي...**Student's ID**..0162943.....

Note 1: Following are 10 multiple-choice questions. Write the symbol of correct answer in the answers' table. ***Only*** the answers in the table will be graded.
Note 2: Ignore air resistance in all problems and take $|g| = 9.8\ m/s^2$ at the Earth's surface.
Note 3: The significant digit notation is not taken into account throughout the given answers.

Answers' Table

Question Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Symbol of Correct Answer	b	b	c	e	b	e	d	b	a	b	e	c	c	a	a

Q.1: A force $\vec{F} = (2\hat{i} - \hat{j})N$ acts on an object. The work (in J) that this force does as the object moves from the origin (0, 0, 0) to the point (13, 11, 0) m is:
[Hint: the displacement of the particle is: $\Delta\vec{r} = (13\hat{i} + 11\hat{j})m$]

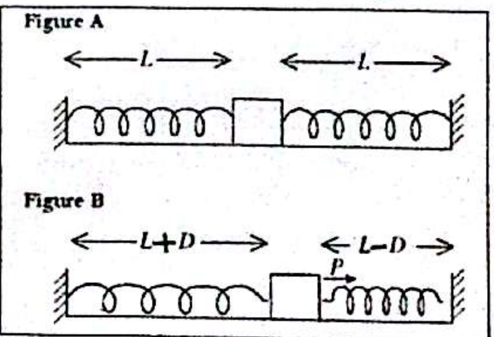
a. 246 b. 26 c. 37 d. 15 e. 100

Q.2: The work performed as a function of time for a process is given by $W = at^3$, where $a = 2.4\ J/s^3$. The instantaneous power output (measured in W) at $t = 8.7\sec$ is:

a.138 b. 545 c. 125 d. 207 e. 912

Q.3: In the adjacent figure, two identical ideal massless springs have unstretched lengths of 0.25 m and spring constants of 550 N/m. The springs are attached to a small cube and stretched to a length L of 0.30 m as in Figure A. An external force P pulls the cube a distance $D = 0.020$ m to the right and holds it there. (See Figure B.) The external force P, that holds the cube in place in Figure B, is:

a. 34 N b. 45 N c. 28 N
d. 22 N e. 11 N

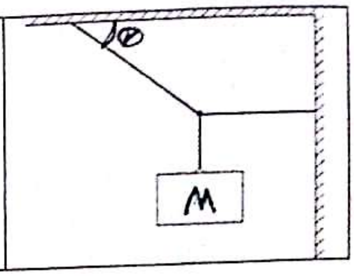


Q.4: A force $F = bx^3$ acts in the x direction, where the value of b is 3.7 N/m³. The work (in J) done by this force in moving an object from $x = 0.00$ m to $x = 2.6$ m is:

a. 98.4 b. 27.3 c. 50.4 d. 9.8 e. 42.2

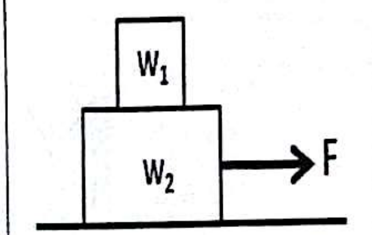
Q.5: In the adjacent figure, a block of mass M hangs at rest. The rope that is fastened to the wall is horizontal and has a tension off 52 N. The rope that is fastened to the ceiling has a tension of 104 N, and makes an angle θ with the ceiling. The angle θ (measured in degrees) is:

a. 55 ° b. 60° c. 30° d. 85° e. 15°



Q.6: A weight W_1= 20 N rests on a second weight W_2 = 50 N on a perfectly smooth horizontal floor as shown in the adjacent figure. When a horizontal force F = 15 N is applied on the lower box (see adjacent figure), both boxes move together. The magnitude (in N) and direction of the net external force on the upper box is:

a. 6.48 N to the right b. 6.48 N to the left
c. 4.28 N to the left d. 4.28 N to the right
e. Zero

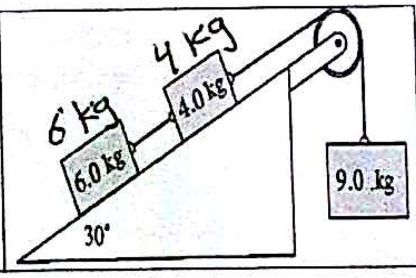


Q.7: A 5.00-kg box slides 9.00 m across a horizontal floor before coming to rest. If the box had an initial speed of 3.00 m/s, then, the coefficient of kinetic friction (μ_K) between the floor and the box is:

a. 0.412 b. 0.587 c. 0.321 d. 0.051 e. 0.115

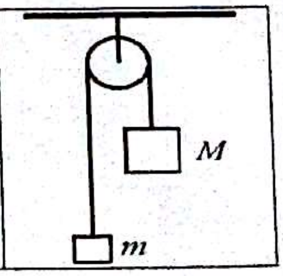
Q.8: A system comprising blocks, a light frictionless pulley, a frictionless incline, and connecting ropes is shown in the adjacent figure. The 9.0-kg block accelerates downward when the system is released from rest. The tension in the rope connecting the 6.0-kg block and the 4.0-kg block (measured in N) is:

a. 80 b. 12 c. 42 d. 99 e. 60



Q.9: Two objects are connected by a very light flexible string that passes over a very light and frictionless pulley as shown in the adjacent figure. Neglecting air resistance. If M = 0.60 kg and m = 0.40 kg, the tension in the string (measured in N) is:

a. 4.7 b. 21.1 c. 14.3 d. 9.8 e. 19



Q.10: True or False:
" The action and reaction forces are equal in magnitude, opposite in direction and act on the same objects"

a. True b. False

Q.11: Two moons orbit a planet in nearly circular orbits. Moon A has orbital radius r, and moon B has orbital radius $4r$. Moon A takes 15 days to complete one orbit. Neglecting gravitational interactions between the two moons, the time (measured in days) needed for moon B to complete an orbit is:

a. 360 b. 180 c. 80 d. 160 e. 120

Q.12: Planet X has a mass equal to 1/3 that of Earth, a radius equal to 1/3 that of Earth, and an axial spin rate 1/2 that of Earth. With g representing, as usual, the acceleration due to gravity on the surface of Earth, the acceleration due to gravity on the surface of planet X is:

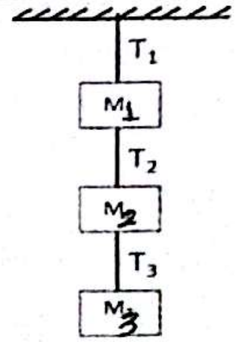
a. g/3 b. g/9 c. 3g d. 6g e. 9g

Q.13: A block is on a frictionless horizontal table, on earth. This block accelerates at 3 m/s^2 when a 90 N horizontal force is applied to it. The block and table are then set up on the moon where the acceleration due to gravity is 1.62 m/s^2. The weight (measured in N) of the block on the moon is:

a. 93.7 b. 76.7 c. 48.6 d. 28.2 e. 36.8

Q.14: The adjacent figure shows a setup of three masses that are connected by three wires. The whole system is under static equilibrium. If $m_1 = 10$ kg, $m_2 = 20$ kg and $m_3 = 70$ kg, The tension (T_1) in the first wire (measured in Newtons) is:

a. 980 b. 518 c. 294 d. 426 e. 686



Q. 15: True or False:
" Any non-accelerating frame of reference is considered as an inertial reference frame"

a. True b. False

Good Luck!!!

Fall 16/17

1) $W = \vec{F} \cdot \vec{d}$

$= (13)(2) + (-1)(11)$

$= 15$

D) 15

2) $P_{inst} = \dfrac{dW}{dt}$

$= 7.2\, t^2$

$P @ t = 8.7 = 544.968$

B) 545

3)

$F_s = K \Delta x$

$K \dfrac{7}{100} = K \dfrac{3}{100} + P$

$P = \dfrac{4}{100} (550)$

$P = 22$

D) 22

4) $W = \int_{x_1}^{x_2} F \cdot dx$

$W = \int_{0}^{2.6} 3.7x^3 \cdot dx = 42.27$

E) 42.2

5)

$52 = 104 \cos\theta$

$\theta = 60°$

B) 60°

6) $F = ma$

$15 = (7)\,a$

$a = 2.143$

$F_1 = m_1 a$

$F_1 = 2\,(2.143)$

$F_1 = 4.28$

D) 4.28 N to the right

7) $\frac{1}{2} m v_i^2 = f_k d$

$\frac{1}{2}(5)(9) = (5)(10)\mu_k(9)$

$\mu_k = 0.05$

D) 0.051

8) $90 - T_1 = 9a$ --- ①

$T_1 - T_2 - 40\sin 30 = 4a$ --- ②

$T_2 - 30 = 6a$ --- ③

mode → EQN → 2

$T_1 = 71.05$

$T_2 = 42.63$

$a = 2.1$

c) 42

9) $6 - T = 0.6a$

$T - 4 = 0.4a$

mode → EQN → 1

$T = 4.8$

$a = 2$

A) 4.7

10) FALSE

"Act on different objects"

B) False

11) $\frac{r_A^3}{T_A^2} = \frac{r_B^3}{T_B^2}$

$\frac{r^3}{(15)^2} = \frac{64 r^3}{T_B^2}$

E) 120

$T_B = 120$ days

12) $g = \frac{GM}{r^2}$

$F = \frac{G\frac{m}{3}}{\frac{r^2}{9}} = \frac{3GM}{r^2} = 3g$

E) 3g

13) $F = mg$ $\quad$ $w = mg^*$

$90 = m\,3$ $\quad$ $= 30(1.62)$

$m = 30$ kg $\quad$ $w = 48.6$

C) 48.6

14) $T_1 = (10+20+70)(9.8)$

$T_1 = 980$

A) 980

15) TRUE

A) True

Lecturer's Name: أ. د. أكرم غنمة **Time: 16:00–17:10**

*Take $g = 9.8$ m/s^2 and $G = 6.7 \times 10^{-11}$ N.m^2/kg^2.

** Fill in the Table at the END with your answers, using CAPITAL letters ONLY.

Q1) Only two forces act on a 5.0-kg mass. These are $F_1 = (2i - 4j)$ N and $F_2 = (3i - 6j)$ N. The magnitude of the resulting acceleration (in m/s^2) is:

(A) 1.0 (B) 2.0 (C) 5.0 (D) 0.22 (E) 2.2

Q2) A 5.0-kg mass is suspended (مُعلّق) by a string from the ceiling (سقف) of an elevator. The tension in the string is 50 N. The acceleration (in m/s^2) of the elevator is:

(A) 9.8, downward (B) 9.8, upward (C) 0.20, upward (D) 2.0, upward (E) 2.0, downward

---

Q3)

In the above figure, the surfaces are frictionless and force P = 10 N. The magnitude of the force (in N) exerted (المؤثرة) on block 1 by block 2 is:

(A) 10 (B) 8.0 (C) 6.0 (D) 4.0 (E) 2.0

Q4) A block is released from rest on a 30^0-incline and slides 9.0 m in 3.0 s. What is the coefficient of kinetic friction between the block and the surface of the incline?

(A) 0.17 (B) 0.81 (C) 0.34 (D) 0.28 (E) 0.22

Q5) A mass of 1.0 kg, attached to the end of a string, swings in a vertical circle of radius 2.0 m. When the mass is at the lowest point of the circle, its speed is 10 m/s. The tension (in N) in the string at this point is:

(A) 60 (B) 40 (C) 30 (D) 20 (E) 10

Q6) A point is at a distance $4R_E$ above the surface of the Earth (R_E being the Earth's radius which you need *not* know). The magnitude of the free-fall acceleration (in m/s^2) at this pont is:

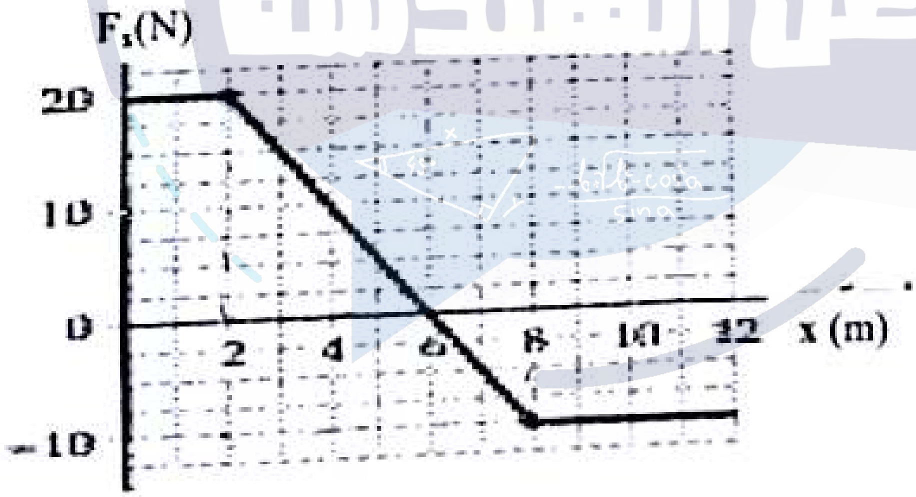
(A) 9.8 (B) 2.0 (C) 2.5 (D) 0.39 (E) 0.61

Q7) The initial velocity of a 5.0-kg particle is $(2.0\hat{i} - 5.0\hat{j})$ m/s. After t s, the velocity becomes $((5.0\hat{i} - 6.0\hat{j})$ m/s. The work done (in J) by the *resultant* force during this time interval is:

(A) zero (B) 100 (C) 80 (D) 10 (E) 425

Q8) A particle moves along the x-axis. It is acted upon by a force F_x (in N) that varies with position x (in m) as shown in the graph below. What work (in J) is done by this force as the particle moves from x = 2 m to x = 12 m?

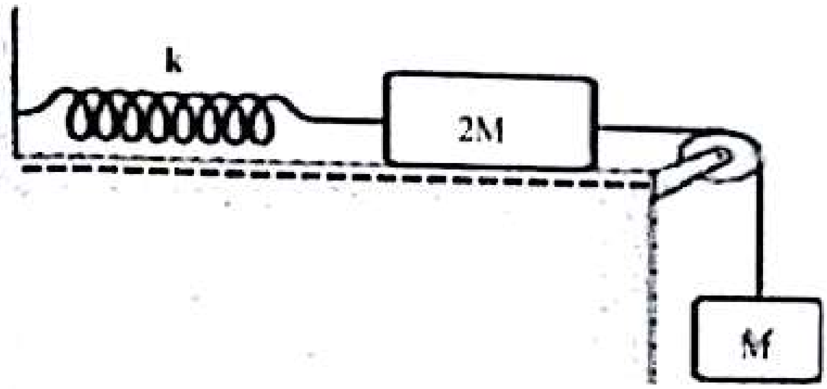
(A) +40 (B) −30 (C) +30 (D) −10 (E) +10



Q9) A 1.0-kg block slides (يتزلق) down a 30°-incline at a constant speed of 10 m/s. At what rate (in W) is work done on the block by the gravitational force?

(A) +49 (B) −98 (C) zero (D) +100 (E) −100

Q10)



In the above figure, the system is released from rest with the spring in its equilibrium position. The pulley and the horizontal surface are frictionless. If the spring constant k = 600 N/m and M = 5.0 kg, what is the maximum extension (امتداد) (in cm) of the spring?

(A) 50 (B) 16 (C) 80 (D) 24 (E) 20

Q11) A 5.0-kg particle is dropped from rest. After falling a distance of 100 m, it has a speed of 25 m/s. What is the work done (in kJ) by the nonconservative air-resistive force on the particle during this fall?

(A) +2.0 (B) −2.5 (C) +2.9 (D) −3.3 (E) −3.9

Q12) The potential energy function for a certain system is given (in J) by the expression $U(x,y) = x^2y^4 - 4x + 3y$, where x and y are in m. The magnitude of the corresponding force (in N) at x = 1.0 m and y = 1.0 m is:

(A) zero (B) 6.0 (C) 9.0 (D) 7.0 (E) 7.3

Fill in the Table below with your answers, using CAPITAL letters ONLY:

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
E	C	E	A	A	E	C	C	A	A

Q11	Q12
D	E

1) $\vec{F}_{eq} = (2+3)\hat{i} + (-10)\hat{j}$ $a = \sqrt{5} = 2.23$

$|F| = 5\sqrt{5}$

$F = ma$

$5\sqrt{5} = 5a$

E) 2.2

2) $T - mg = ma$

$50 - 49 = 5a$

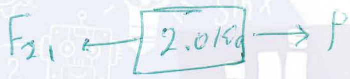
$a = 0.2$

C) 0.20 upward

3) ~~$P = (2+3+10$~~

$P = (2+3+5)\ a$

$a = 1\ m/s^2$



$10 - F_{21} = 2(1)$

$F_{21} = 8$

B) 8

4) $\Delta x = \frac{1}{2} a t^2$

$9 = \frac{1}{2} a\, 9$

$a = 2\ m/s^2$

$mg \sin(30) - mg \cos(30)\ \mu_K = ma$

$\mu_K = -\left(\frac{2-5}{\cos 30}\right)$

$\mu_K = 0.346$

C) 0.34

5) $T - mg = \frac{mv^2}{R}$

$T - 10 = \frac{100}{2}$

$T = 60$

A) 60

6) $g = \frac{GM}{r^2}$

$g^* = \frac{GM}{(4r+r)^2} = \frac{GM}{25r^2}$

$g^* = \frac{9.8}{25} = 0.392$ D) 0.39

7) $W = F \cdot d$

$v_i = \sqrt{29}$ $W = m(2.425) \times 6.6$

$v_f = \sqrt{61}$ $W = 80.025$ C) 80

$a = 2.425$

$d = 6.6$

8) $\frac{1}{2}(4)(20) - \frac{1}{2}(2)(10) = 30 - 40 = -10$

$-(10)(4)$

~~C) +30~~

D) -10

9) $P = Fv \cos\theta$

$= mg\, v \cos 60$

$= 49$ A) 49

10) $E_1 = E_2$

$mgh = \frac{1}{2} k \Delta x^2$, $h = \Delta x$

$50 = 300 \Delta x$

$\Delta x = 0.16$ m. B) 16 cm.

11) $mgh + W = \frac{1}{2} mv^2$

$4900 + W = 1562.5$

$W = -3337.5 \text{ J}$

$W = -3.33 \text{ KJ}$

D) -3.3

12) $F_x = \frac{\partial U}{\partial x} = 2xy^4 - 4$

$F_y = \frac{\partial U}{\partial x} = 4x^2y^3 + 3$

$\vec{F} = (2xy^4 - 4)\hat{i} + (4x^2y^3 + 3)\hat{j}$

$\vec{F} = -2\hat{i} + 7\hat{j}$

$|F| = \sqrt{4 + 49}$

$F = 7.28$

E) 7.3

The University Of Jordan
Pysics Department
General Physics I (0302101) / Second Exam / Aug 6th 2016
Summer Semester 2015/2016

الرقم الجامعي: اسم الطالب:

رقم الشعبة: اسم المدرس:

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

Answer All The Following Questions

1. A mass of 25 kg is acted on by two forces: force F_1 is 25 N due east, and force F_2 is 15 N due north. The magnitude of the acceleration (in m/s^2) of the mass is:

a) 1.17 b) 2.41 c) 3.63 d) 2.15 e) 4.26

2. A 0.20-kg object attached to the end of a string swings in a vertical circle (radius = 80 cm). At the top of the circle the speed of the object is 4.5 m/s. The magnitude of the tension (in N) in the string at this position is:

a) 2.0 b) 3.1 c) 6.4 d) 7.6 e) 18.8

3. A force accelerates a body of mass M. The same force applied to a second body produces three times the acceleration. The mass of the second body is:

a) M b) 3M c) M/3 d) 9M e) M/9

4. It takes 32.0 J of work to stretch a spring 20.0 cm from its unstressed length. The extra work (in J) required to stretch the spring an additional 10.0 cm is:

a) 16 b) 14 c) 40 d) 12 e) 51

5. The required work (in kJ) for a 2000 kg car moving on a horizontal road to increase its velocity from (2i + 3j) m/s to (5i + 12j) m/s is:

a) 156 b) 182 c) 312 d) 243 e) 426.3

6. A constant resultant force of (2i + 5j) N affects an object and causes it to move with constant velocity of 4j m/s. The power (in Watts) required for this process is:

a) 20 b) 12 c) 42 d) 28 e) 17

7. A 25.0 kg block is initially at rest on a horizontal surface. A horizontal force of 75.0 N is required to set the block in motion. After it is in motion, a horizontal force of 60.0 N is required to keep the block moving with constant speed. The coefficient of kinetic friction is:

a) 0.31 b) 1.0 c) Zero d) 0.24 e) 0.1

---

8. A force acting on an object moving along the x axis is given by $F = (14\,x - 3.0\,x^2)$ N, where x is in m. The work (in Joules) done by this force as the object moves from $x = -1$ m to $x = 2$ m is:

a) 12 b) 28 c) 40 d) 42 e) − 28

---

9. A 2.0 kg mass is projected from the edge of the top of a 20 m tall building with a velocity of 24 m/s. Ignoring air resistance, the kinetic energy (in kilo Joules) of the mass just before it strikes the leveled ground is:

a) 0.18 b) 0.97 c) 0.89 d) 0.26 e) 0.4

---

10. A 700 N university student in basic training climbs a 10.0 m vertical rope at a constant speed in 8.00 s. His power output (in Watts) is:

a) 560 b) 600 c) 900 d) 700 e) 875

---

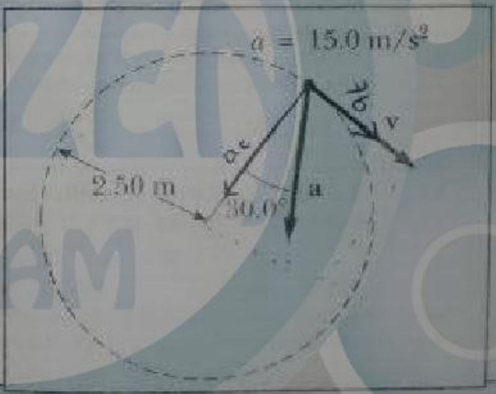
11. A potential energy function for a two-dimensional force is of the form $U = 3x^2y - 7x$. The force components that act at the point (1, 0) are:

a) (-7, 3) b) (3, -7) c) (7, -3) d) (-3, 7) e) (0, 0)

---

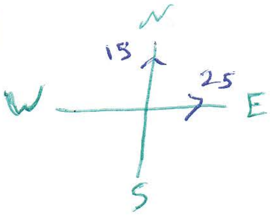
12. The figure represents the total acceleration of a particle moving clockwise in a circle of radius 2.50 m at a certain time. At this instant, the tangential acceleration (in m/s²) is:

a) 13
b) 5.7
c) 7.5
d) Zero
e) 15



Summer 15/16

1)



$|F| = \sqrt{15^2 + 25^2}$

$F = ma$

$29.15 = 25\,a$

$a = 1.166\ m/s^2$

A) 1.17

2) $T + mg = mv^2/r$

$T + 2 = \frac{0.2(4.5)^2}{0.8}$

$T = 3.0625$

B) 3.1

3) $F_1 = F_2$

$M d = m(3d)$

$m = \frac{M}{3}$

C) $M/3$

4) $W = \frac{1}{2} K (x_f^2 - x_i^2)$

$32 = \frac{1}{2} K \frac{4}{100}$

$K = 1600$

$W = \frac{1}{2}(1600)\left(\frac{9}{100} - \frac{4}{100}\right)$

$W = 40\ J$

C) 40

5) $v_f = 169$

$v_i = 13$

$w = \frac{1}{2}(2000)(169-13)$

$w = 156000 J$ A) 156

6) $P = F.v$

$P = 2(0) + 5(4) = 20$ A) 20

7) $F - F_s = ma \to 0$

$60 = 250 \mu_k$

$\mu_k = 0.24$ D) 0.24

8) $W = \int F.dx$

$= \int_{-1}^{2} 14x - 3x^{③ \to 2} .dx$

$= 12$ A) 12

9) $mgh + \frac{1}{2}mv^2 = mgh + KE_2$

$400 + 567 = KE_2$

$KE_2 = 967$ B) 0.97

10) $P = \frac{W}{t} = \frac{mg\,\Delta x}{t}$

$P = \frac{(700)(10)}{8}$

$P = 875$

E) 875

11) $F_x = \frac{-\partial u}{\partial x} = -(9x^2y - 7)$ @ $(1,0) = 7$

$F_y = \frac{-\partial u}{\partial y} = -(3x^3)$ @ $(1,0) = -3$

(7, -3)

c) (7, -3)

12) $a_t = a \sin 30$

$a_t = 15\left(\frac{1}{2}\right)$

$a_t = 7.5$

c) 7.5

The University of Jordan / Department of Physics
First Semester 2015/2016
Physics 101/ Second Exam

Section number : ____ KEY __ **Student name (بالعربية):_______________**
Lecturer name :______________ **Student number :_______________**

✓ Some helpful information: gravitational acceleration $g = 9.8\ m/s^2$

Notes: **Turn off your cell phone and put it out of sight**. Keep your calculator on your own desk. **Calculators** cannot be shared. You have **75 minutes** to complete your exam.
Be sure to **fill the box** below with your final answers before the end of the exam.

	A	B	C	D	E		A	B	C	D	E
1						7					
2						8					
3						9					
4						10					
5						11					
6						12					

1. A particle of mass (11 kg) is subject to two forces such that one force has a magnitude of 21 N directed east, and the other force has a magnitude of 39 N directed east-north, what is the magnitude of the particle's acceleration (in m/s^2)?

   (A) 2.8 (B) 5.1 (C) 7.5 (D) 3.7 (E) 12

2. An object of mass 4.0-kg is placed on top of an elevator floor. If the force exerted by the floor on the object is equal to 38 N. What is the acceleration of the elevator (in m/s^2)?

   (A) 0.8 upward (B) 0.8 downward (C) 1.3 upward (D) 1.3 downward (E) 0.3 downward

3. A force of magnitude 20N directed in the positive x direction is acting on a particle and displacing it from the point (2m, -1m) to the point (4m, -3m). What is the work done by the force (in J)?

   (A) 60 (B) 40 (C) 30 (D) 80 (E) 70

4. A certain pendulum consists of a 1.5-kg mass swinging at the end of a string (length = 2.0 m). At the lowest point in the swing the tension in the string is equal to 20 N. To what maximum height (in cm) above this lowest point will the mass rise during its oscillation?

   (A) 36 (B) 20 (C) 30 (D) 28 (E) 17

5. A spring (k = 600 N/m) is placed in a vertical position with its lower end supported by a horizontal surface. The upper end is compressed 20 cm, and a 4.0 kg block is placed on the compressed (مضغوط) spring. The system is then released from rest. How far above the point of release will the block rise (in cm)?

   (A) 20 (B) 31 (C) 10 (D) 15 (E) 25

6. A potential energy function for a two-dimensional force is of the form $U = 3x^2 y$. Find the force that acts at the point (1, 1).

(A) $\vec{F} = -12\hat{i} - 3\hat{j}$ (B) $\vec{F} = -6\hat{j}$ (C) $\vec{F} = -24\hat{i} - 12\hat{j}$ (D) $\vec{F} = -6\hat{i} - 3\hat{j}$ (E) $\vec{F} = -6\hat{i}$

7. A 6.0-kg block slides along a horizontal surface. If μ_k= 0.20 for the block and surface, at what rate is the friction force doing work on the block (in W) at an instant when its speed is 4.0 m/s?

(A) -63 (B) -47 (C) +50 (D) +25 (E) -55

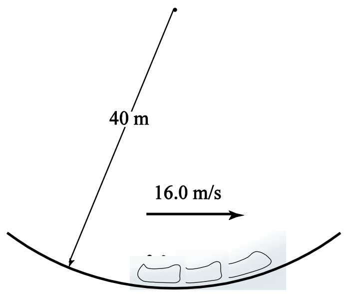
8. A particle of mass (1.5 kg) is moving on the x-axis with an acceleration given as $a = (6.0x + 5.0)\, m/s^2$, What is the speed of the particle in (m/s) at the moment it reaches x = 4.0 m, given that the particle started motion from origin with initial velocity 2.0 m/s?

(A) 10.1 (B) 14.7 (C) 11.8 (D) 13.1 (E) 9.5

9. An airplane moves at constant speed of 140 m/s as it travels around a vertical circular loop which has a 1.0-km radius. What is the magnitude of the net force causing the centripetal acceleration on the 71-kg pilot (in N)?

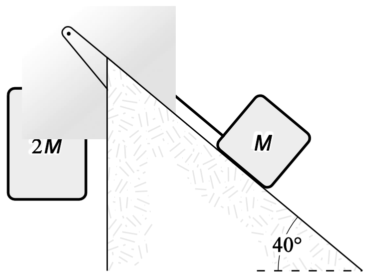
(A) 1000 (B) 1392 (C) 1200 (D) 1310 (E) 1022

10. A roller-coaster car has a mass of 400 kg when fully loaded with passengers (ركاب). At the bottom of a circular dip of radius 40 m (as shown in the figure) the car has a speed of 16 m/s. What is the magnitude of the force the track exerts on the car at the bottom of the dip (in kN)?



(A) 10.1 (B) 9.7 (C) 8.1 (D) 13.1 (E) 6.5

11. What is the magnitude of the tension in the string (in N) if M= 2.0 kg in the figure shown? Assume the surface is frictionless.



(A) 21. (B) 19.7 (C) 32.2 (D) 42.9 (E) 56.5

12. A box of mass (42 kg) is placed on top of a rough horizontal surface whose coefficients of friction are ($\mu_s = 0.6, \mu_k = 0.4$). If a man tried to push the box by applying a force of (210 N), what would be the magnitude of the friction force (in N)?

(A) 210 (B) 247 (C) 220 (D) 165 (E) 230

Fall 15/16

1) $F = (21 + 39\cos(45))\hat{i} + (39\cos(45))\hat{j}$

$|F| = 55.859$

$F = ma$

$a = 5.07$

B) 5.1

2) $38 - 40 = ma$

$a = -0.3\ m/s^2$

E) 0.3 downward

3) $\vec{d} = 2\hat{i} - 4\hat{j}$

$W = \vec{F}.\vec{d}$

$= 2(20) + (-4)(0)$

$= 40\ J$

B) 40

4) $T - mg = \frac{mv^2}{r}$

$20 - 15 = \frac{(1.5)\,v^2}{2}$

$v^2 = \frac{20}{3}$

$\frac{1}{2} m v^2 = mgh$

$\frac{1}{2}\ \frac{20}{3} = 10h$

$h = 0.33\,m$

$h = 33\,cm$

B) 31

5) $\frac{1}{2} K x^2 = mgh$

$\frac{1}{2}(600)(-0.2)^2 = 4(9.8)\,h$

$h = 0.306\ m$

B) 31

6) $\vec{F} = -\frac{\partial u}{-\partial x}\hat{i} - \frac{\partial u}{\partial y}\hat{j}$

$\vec{F} = -6xy\,\hat{i} - 3x^2\,\hat{j}$ @ (1,1)

$\vec{F} = -6\hat{i} - 3\hat{j}$

D) $-6\hat{i} - 3\hat{j}$

7) ~~$\Sigma F = ma$~~

$f_k = N\mu_k$

$= 12$

$W = F \cdot v\cos\theta \rightarrow 180$

$W = -48$

B) −47

8) $F = ma$

$F = 9x + 7.5$

$W = \int_0^4 F \cdot dx$

$W = 102$

$W = \Delta KE$

$102 = \frac{1}{2}(1.5)(v_f^2 - 4)$

$v_f^2 = 141.3$

$v_f = 11.88$

c) 11.8

9) $F_r = \frac{mv^2}{r}$

$= \frac{71(140)^2}{1}$

$= 1391600\ N$

$= 1391.6\ kN$

13) 1392

10) $F_N - mg = \frac{mv^2}{R}$

$F_N = 4000 + \frac{400(16)^2}{40}$

$F_N = 6560\ N$

$F_N = 6.56\ kN$

E) 6.5

11) $40 - T = 4a$ --- (1)

$T - 20\sin 40 = 2a$ --- (2)

$T = 21.9$

$a = 4.5$

A) 21

12) $f_s = N\mu_s$

$= 252$

$252 > 210$

$f_s = 210\ N$

A) 210

University of Jordan **Date: 31/12/2013**
Faculty of Science **First Semester**
Department of Physics **Time: 4:00 – 5:00 pm**

General Physics I – PHYS. 0302101
Makeup Second Exam

Name (In Arabic): KEY ANSWER **Instructor:**
Student Number: **Section:**

Constants: g = 9.8 m/s^2

- Choose the closest correct answer and fill the Answer Table.

(Q1) A 0.5-*kg* mass attached to the end of a string swings in a vertical circle of radius equals 2.0 *m*. When the mass is at the lowest point on the circle, the speed of the mass is 12 *m/s*. The magnitude of the force (in *N*) of the string on the mass at this position is:
(A) 31 ; **(B)** 36 ; **(C)** 41 ; **(D)** 46 ; **(E)** 57 ;

(Q2) A particle moves in a circular path with constant speed. Its acceleration is:
(A) Zero ; **(B)** constantly increasing ; **(C)** constant in direction ;
(D) constant in magnitude and direction ; **(E)** constant in magnitude ;

(Q3) A 2.0-*kg* particle has an initial velocity of $(5\hat{\mathbf{i}} - 4\hat{\mathbf{j}})$ *m/s*. Sometime later, its velocity is $(7\hat{\mathbf{i}} + 3\hat{\mathbf{j}})$ *m/s*. How much work was done by the resultant force during this time interval, assuming no energy (in *J*) is lost in the process?
(A) 17 ; **(B)** 34 ; **(C)** 19 ; **(D)** 53 ; **(E)** 27 ;

(Q4) Equal amounts of work are performed on two bodies, ***A*** and ***B***, initially at rest, and of masses *M* and 2*M* respectively. The relation between their speeds immediately after the work has been done on them is:
(A) $v_B = \sqrt{2} v_A$; **(B)** $v_B = 2\ v_A$; **(C)** $v_A = v_B$; **(D)** $v_A = \sqrt{2} v_B$; **(E)** $v_A = 2\ v_B$;

(Q5) A pendulum is made by letting a 2.0-*kg* object swing at the end of a string that has a length of 1.5 *m*. The maximum angle the string makes with the vertical as the pendulum swings is 30°. If air resistance is neglected, the speed (in *m/s*) of the object at the lowest point in its trajectory is:
(A) 1.6 ; **(B)** 2.0 ; **(C)** 2.5 ; **(D)** 2.7 ; **(E)** 3.1 ;

(Q6) A 10-*N* force acts on a 2.0-*kg* object initially at rest. The rate at which the force is doing work (in *Watt*) at time t = 2.0 *sec* is:
(A) 900 ; **(B)** 200 ; **(C)** 500 ; **(D)** 400 ; **(E)** 100 ;

(Q7) In a given displacement of a particle, its kinetic energy increases by 25 *J* while its potential energy decreases by 10 *J*. The work (in *J*) of the non-conservative forces acting on the particle during this displacement is:
(A) – 15 ; **(B)** +35 ; **(C)** +15 ; **(D)** – 35 ; **(E)** +55 ;

(Q8) A 3.0-*kg* ball with an initial velocity of (4 î + 3 ĵ) *m/s* collides with a wall and rebounds with a velocity of (–4 î + 3 ĵ) *m/s*. The impulse (in *N.s*) exerted on the ball by the wall is:

(A) – 24 î ; **(B)** 24 î ; **(C)** +18 ĵ ; **(D)** – 18 ĵ ; **(E)** –16 î ;

(Q9) A 2.0-*kg* object moving with a velocity of 5.0 *m/s* in the positive *x* direction collides with and sticks to an 8.0-*kg* object initially at rest. How much kinetic energy (in *J*) is lost in this collision?

(A) 15 ; **(B)** 30 ; **(C)** 25 ; **(D)** 20 ; **(E)** 5 ;

(Q10) The turntable of a record player has an initial angular velocity of 8.0 *rad/s* at the moment when it is turned off. The turntable comes to rest 2.5 *s* after being turned off. Through how many radians does the turntable rotate after being turned off? Assume constant angular acceleration.

(A) 12 ; **(B)** 8.0 ; **(C)** 10 ; **(D)** 16 ; **(E)** 6.8 ;

(Q11) Two points ***A*** and ***B*** are located on a disk that rotates about its axis. Point ***A*** is *four* times as far from the axis as point ***B***. If the tangential speed of point ***B*** is equal to **v**, then the tangential speed of point ***A*** is:

(A) *v* ; **(B)** 4 *v* ; **(C)** 3 *v* ; **(D)** 2 *v* ; **(E)** 5 *v* ;

(Q12) Two particles (m_1 = 0.20 *kg*, m_2 = 0.30 *kg*) are positioned at the ends of a 2.0-*m* long rod of negligible mass. The moment of inertia (in $kg.m^2$) of this system about an axis perpendicular to the rod and through the center of mass is:

(A) 0.38 ; **(B)** 0.75 ; **(C)** 1.2 ; **(D)** 0.48 ; **(E)** 1.7 ;

-Answer Table-

Fill the appropriate square of the correct answer with (X).

Q's	A	B	C	D	E	Q's	A	B	C	D	E
1						**7**					
2						**8**					
3						**9**					
4						**10**					
5						**11**					
6						**12**					

Subject Date No.

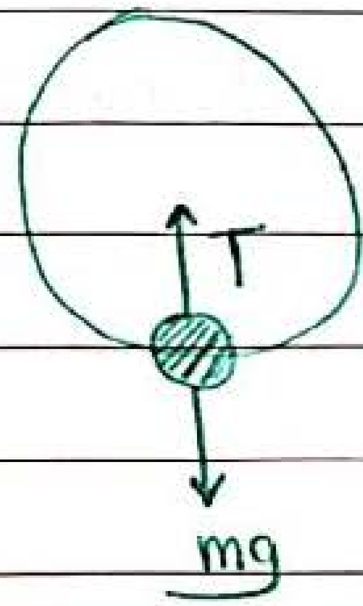
First semester (2013) – Makeup second Exam.

Q_1: $m = 0.5\ Kg$

$r = 2\ m$

$V = 12\ m/s$

$F = ?$



$$\Sigma F = \frac{mv^2}{r}$$

$$T - mg = \frac{mv^2}{r} \Rightarrow T = \frac{0.5 * (12)^2}{2} + 0.5 * 9.8$$

$$= 41\ N$$

Q_3: $m = 2Kg$, $V_1 = (5i - 4j)\ m/s$, $W = ?$

$V_2 = (7i + 3j)\ m/s$

$$|V_1| = \sqrt{(5)^2 + (4)^2} = 6.4$$

$$|V_2| = \sqrt{(7)^2 + (3)^2} = 7.6$$

$$W = \Delta KE = \frac{1}{2} m (V_2^2 - V_1^2) = \frac{1}{2}(2)((7.6)^2 - (6.4)^2)$$

$$= 17\ J$$

Q_4: $V_{1A} = V_{1B} = zero$

$$W_A = \Delta KE = \frac{1}{2} m_A (V_2^2 - V_1^2) = \frac{1}{2} m_A V_{(A)}^2$$

$$W_B = \Delta KE = \frac{1}{2} m_B (V_2^2 - V_1^2) = \frac{1}{2} m_B V_{(B)}^2$$

←

NOTEBOOK

Subject Date No.

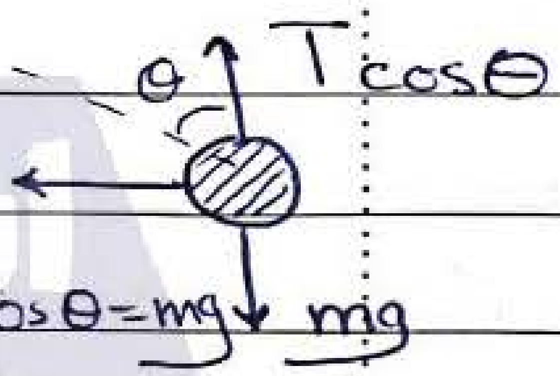
$$\frac{W_A}{W_B} = \frac{\frac{1}{2} m_A V_A^2}{\frac{1}{2} m_B V_B^2} \Rightarrow 1 = \frac{M\, V_A^2}{2M\, V_B^2}$$

$$\Rightarrow V_A^2 = 2 V_B^2$$

$$V_A = \sqrt{2}\, V_B$$

Q5: $m = 2\,Kg$, $l = 1.5\,m$, $\theta_{max} = 30°$

$V = ?$



$r = l \sin\theta$

$= 0.75\,m$

$\Sigma F_y = 0 \Rightarrow T\cos\theta = mg$

$\therefore T = \frac{mg}{\cos\theta}$

$\Sigma F_r = \frac{m v^2}{r}$

$T \sin\theta = \frac{m v^2}{r} \Rightarrow \frac{mg}{\cos\theta}\sin\theta = \frac{m v^2}{r}$

$\Rightarrow v = \sqrt{r g \tan\theta} = \sqrt{0.75 * 9.8 * \tan 30}$

$= 2.0\ m/s$

Q6: $F = 10\,N$, $m = 2\,Kg$, $V_1 = 0$, $t = 2\,sec$

$P = ?$

1. $\Sigma F_x = ma \Rightarrow a = \frac{10}{2} = 5\,m/s^2$
2. $V_2 = V_1 + at \Rightarrow V = 5 * 2 = 10\ m/s$
3. $P = F \cdot V = 10 * 10 = 100$ watt

NOTEBOOK

Subject Date No.

Q7 :- $\Delta KE = 25 J$, $\Delta U = -10 J$, $W = ?$

$$W = \Delta KE + \Delta U$$
$$= 25 - 10 = +15 J$$

Q8 :- $m = 3 Kg$, $V_1 = (4i + 3j) m/s$, $\vec{I} = ?$
$V_2 = (-4i + 3j) m/s$

$$\vec{I} = m(\vec{V}_2 - \vec{V}_1)$$
$$= 3(-4i + 3j - 4i - 3j)$$
$$= 3(-8i) = -24i \ N.s$$

Q9 :- $m_A = 2 Kg$, $V_{A_1} = 5 m/s$, $\Delta KE = ?$
$m_B = 8 Kg$, $V_{1(m_B)} = 0$

$$P_1 = P_2$$
$$m_A V_{A_1} + m_B V_{B_1} = (m_A + m_B) V_2$$
$$10 = 10 V_2 \Rightarrow V_2 = 1 m/s$$

$$\Delta KE = K_2 - K_1$$
$$= \frac{1}{2}(m_A + m_B) V_2^2 - \left(\frac{1}{2} m_A V_A^2 + \frac{1}{2} m_B V_B^2\right)$$
$$= \frac{1}{2}(10)(1)^2 - \frac{1}{2} * 2 * 25 = -20 J$$

Subject Date No.

Q10: $\omega_1 = 8$ rad/s , $\Delta t = 2.5$ s , $\theta_2 = ?$

$\omega_2 = 0$

$\omega_2 = \omega_1 + \alpha t$

$0 = 8 + 2.5\alpha$

$\alpha = -3.2$ rad/s^2

$\theta_2 = \theta_1 + \omega_1 t + \frac{1}{2}\alpha t^2$

$= 0 + 8(2.5) + \frac{1}{2}(-3.2)(2.5)^2$

$= 10$ rad

Q11: $r_A = 4r_B$, $\omega_A = \omega_B$

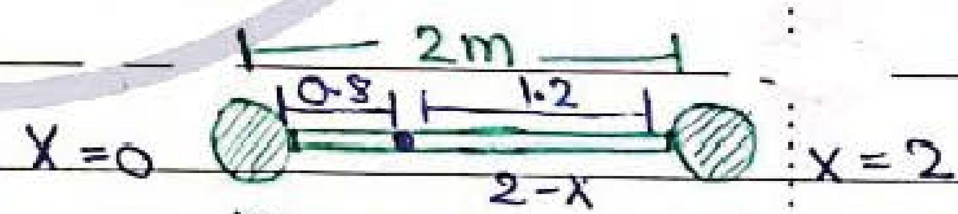
$v_B = r_B\omega_B \Rightarrow v = r_B\omega$

$v_A = r_A\omega_A \Rightarrow v_A = 4 r_B v$ v

$\therefore v_A = 4v$

Q12: $m_1 = 0.2$ Kg , $m_2 = 0.3$ Kg

$\ell = 2.0$ m



$I = \Sigma Mr^2 = m_1r_1^2 + m_2r_2^2$

$= 0.48$ Kg.m^2

$= \frac{0.3(0) + 0.2(2)}{0.3 + 0.2}$

$X_{cm} = \frac{0.4}{0.5} = 0.8$

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University of Jordan
Faculty of Science
Department of Physics

Date: 14/12/2013
First Semester
Time: 4:00 – 5:00 pm

General Physics I – PHYS. 0302101
Second Exam

Name (In Arabic): KEY ANSWER
Student Number:

Instructor:
Section:

Constants: g = 9.8 m/s^2

**** Choose the closest correct answer and fill the Answer Table.***

(Q1) An airplane moves 100 m/s as it travels around a vertical circular loop which has a 1.0-km radius. The magnitude of the resultant force (in kN) on the 70-kg pilot of this plane at the bottom of this loop is:

(A) 0.70 ; **(B)** 1.37 ; **(C)** 2.1 ; **(D)** 1.3 ; **(E)** 1.58 ;

(Q2) An object (*a*) of mass *m* flies in a horizontal circle of radius *R* at a speed *v*. Another object (*b*) has the same mass *m* and flies in a horizontal circle of radius *R* at a speed of *v*/2. Then the ratio of the centripetal acceleration of the object (*a*) to that of object (*b*) is:
(A) 0.25 ; **(B)** 0.5 ; **(C)** 1.0 ; **(D)** 2.0 ; **(E)** 4.0 ;

(Q3) Single conservative force acting on an object moving along the *x* axis is given by: $F_x = (14\,x - 3\,x^2)$ *N*, where *x* is in *m*. The Change in potential energy ΔU (in *J*) done by this force as the object moves from $x = -1$ *m* to $x = +2$ *m* is :
(A) – 20.1 ; **(B)** + 38.0 ; **(C)** – 12.0 ; **(D)** + 16.0 ; **(E)** – 28.0 ;

(Q4) A 12-*kg* block on a horizontal frictionless surface is attached to a light spring (force constant = 700 *N/m*). The block is initially at rest at its equilibrium position when a force of magnitude 80 *N* acting parallel to the surface is applied to the block. The speed (in *m/s*) of the block when it is 13 *cm* from its equilibrium position is:
(A) 0.55 ; **(B)** 0.68 ; **(C)** 0.78 ; **(D)** 0.86 ; **(E)** 0.90 ;

(Q5) A constant force of 10 *N* in the negative *y* direction acts on a particle as it moves from the origin to the point $(3\hat{\mathbf{i}} + 3\hat{\mathbf{j}} - 1\hat{\mathbf{k}})$ *m*. The work (in *J*) done by the given force during this displacement is:
(A) – 45 ; **(B)** – 30 ; **(C)** – 60 ; **(D)** +30 ; **(E)** +12 ;

(Q6) A 2.0-*kg* block slides down a plane (inclined at 40° with the horizontal) at a constant speed of 5.0 *m/s*. The Power (in W) at which the gravitational force doing on the block is:
(A) zero; **(B)** - 55.2; **(C)** + 78.7; **(D)** + 94.5; **(E)** + 63.0;

(Q7) Three particles are placed in the *xy* plane. A 30 *g* particle is located at (3, 4) *m*, a 40 *g* particle is located at (−2, −2) *m*. Where a 20 *g* particle must be placed (in *m*) so that the center of mass of the three-particle system is at the Origin?

(A) (– 0.5, –2.0) ; **(B)** (1, 0) ; **(C)** (2.5, 2) ; **(D)** (–3,–14) ; **(E)** (0, –2) ;

(Q8) A 2.0-kg object is moving along the x-axis. Its speed increases from 30 m/s to 40 m/s during a 5.0-s time interval. The magnitude of the average total force (in N) acting on the object during this time interval is:

(A) 2.0 ; **(B)** 3.0 ; **(C)** 4.0 ; **(D)** 5.0 ; **(E)** 6.0 ;

(Q9) A ball falls to the ground from height *H* and bounces to height *h*. Momentum is conserved in the ball-earth system

(A) only if $h > H$; **(B)** only if $h = 0$; **(C)** only if $h = H$;
(D) only if $h \le H$; **(E)** only if $h \ge H$;

(Q10) At $t = 0$, a wheel rotating about a fixed axis at a constant angular acceleration has an angular velocity of 2.0 *rad/s*. Two seconds later it has turned through 5.0 complete revolutions. The angular acceleration (*in* rad/s^2) of this wheel is:

(A) 15.7 ; **(B)** 13.7 ; **(C)** 9.7 ; **(D)** 7.7 ; **(E)** 5.7 ;

(Q11) A wheel rotating about a fixed axis has an angular position given by $\theta = 3 - 2t^3$, where θ is measured in radians and *t* in seconds. The angular velocity (in rad/s) of the wheel at $t = 2.0$ s is:

(A) – 24 ; **(B)** – 38 ; **(C)** – 54 ; **(D)** – 62 ; **(E)** – 96 ;

Q12) A disk with a radius of 2.0 *m* whose moment of inertia is 50 $kg.m^2$ rotates uniformly by angular acceleration of 6.0 rad/s^2. The net force (in *N*) acting tangent to the circumference of this disk is:

(A) 75; **(B)** 100; **(C)** 115; **(D)** 135; **(E)** 150 ;

Answer Table

Fill the appropriate square of the correct answer with (X).

Q's	A	B	C	D	E	Q's	A	B	C	D	E
1						7					
2						8					
3						9					
4						10					
5						11					
6						12					

Subject Date No.

First semester (2013) - Second Exam

Q1:- $v = 100 \, m/s$, $r = 1 \, Km = 10^3 \, m$

$m = 70 \, Kg$, $F = ?$

$$\Sigma F_r = \frac{m v^2}{r}$$

$$= \frac{70 * (100)^2}{10^3} = 700 \, N = 0.7 \, KN$$

Q2:- $m_a = m_b = m$

$r_a = r_b = R$

$v_a = v$

$v_b = \frac{v}{2} = \frac{v_a}{2}$

$$\boxed{a_c = \frac{v^2}{r}} \Rightarrow a_a = \frac{v^2}{R} , \quad a_b = \frac{(v/2)^2}{R} = \frac{v^2}{4R}$$

$$\frac{a_a}{a_b} = \frac{\frac{v^2}{R}}{v^2/4R} = \frac{v^2 \cdot 4R}{R \, v^2} = \boxed{4}$$

Subject Date No.

Q_3:- $F_x = (14x - 3x^2)\,N$

$\Delta U\Big|_{x=-1 \to x=2} = ?$

$$\Delta U = -\int_{-1}^{2} F_x\,dx = -\int_{-1}^{2} 14x - 3x^2\,dx$$

$$= -\left(7x^2 - x^3\right]_{-1}^{2}$$

$$= -\left(28 - 8 - (7 + 1)\right)$$

$$= -(20 - 8) = -12$$

Q4: $m = 12\,Kg$, $K = 700$, $v_1 = 0$, $F = 80$
$x = 0.13\,m$, $v_2 = ?$

$$W = \frac{1}{2}Kx^2 + \frac{1}{2}mv^2$$

$$W = F \cdot x = 0.13 * 80 = 10.4\,J$$

$$10.4 = \frac{1}{2}(700)(0.13)^2 + \frac{1}{2}(12)v^2$$

$$\Rightarrow v = 0.86\,m/s$$

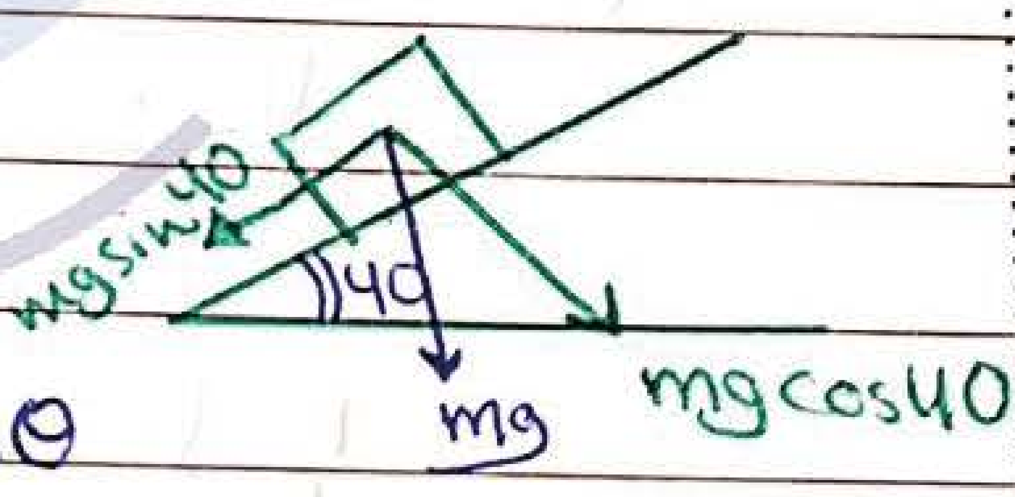
Q5: $F = -10j$, $r = 3\hat{i} + 3\hat{j} - \hat{k}$

$$W = \vec{F} \cdot \vec{r}$$

$$W = -10 * 3 = -30\,J$$

Q6: $m = 2\,Kg$, $\theta = 40^\circ$, $V = 5\,m/s$
$P = ?$

$$F = mg = 19.6\,N$$



$$P = \vec{F} \cdot \vec{V} = F \cdot v \cos\theta$$

$$= 19.6 * 5 * \cos(50)$$

$$= +63\ \text{Watt}$$

$(mg\sin(40) = mg\cos(50))$

Subject Date No.

Q_7: a :- $m_a = 0.03\,Kg$ at $r_a = (3,4)$

b :- $m_b = 0.04\,Kg$ at $r_b = (-2,-2)$

C :- $m_c = 0.02\,Kg$ at $r_c = ??$

$X_{cm}, y_{cm} = (0,0)$

1) $X_{cm} = \dfrac{m_a r_{ax} + m_b r_{bx} + m_c r_{cx}}{m_a + m_b + m_c}$

$0 = 0.01 + 0.02\, r_{cx}$

$-0.5 = r_{cx}$

2) $Y_{cm} = \dfrac{m_a r_{ay} + m_b r_{by} + m_c r_{cy}}{m_a + m_b + m_c}$

$0 = 0.04 + 0.02\, r_{cy}$

$-2 = r_{cy}$

$r_c\,(-0.5, -2)$

Q_8: $m = 2\,Kg$, $V_1 = 30\,m/s$, $V_2 = 40\,m/s$

$t = 5\,s$

$\Sigma F = ma$

$= 2 * 2$

$= 4\,N$

$V_2 = V_1 + at$

$40 = 30 + 5a \Rightarrow a = 2\,m/s^2$

Subject Date No.

Q_{10}:

$\omega_i|_{t=0} = 2$ rad/s , $t_2 = 2$, $N = 5$

$\theta = 5 * (2\pi) = 10\pi$ rad

$\theta = \omega_i t + \frac{1}{2}\alpha t^2$

$\alpha = 13.7$ rad/s^2

Q_{11}:- $\theta = 3 - 2t^3$, $\omega|_{t=2} = ?$

$\omega = \frac{d\theta}{dt} = -6t^2$

$\omega|_{t=2} = -6(4) = -24$ rad/s

Q_{12}: $r = 2m$, $I = 50$ Kg.m^2 , $\alpha = 6$ rad/s^2

$F_t = ?$

$\tau = I\alpha$

$= 50(6) = 300$

$F = \frac{\tau}{r} \Rightarrow F = 150$ N

Physics 101 2011/2012 Second Exam

Q1:- A car ($m = 2234$ kg) and it's velocity is 25 m/s collide with a tree, it needs 0.26 seconds to stopped them;

Find force applied from tree on car ..

Q2:- An object start moving in a circular path from rest, after (10.5) sec., the object has a rate with (12000 rev/min),

Find its angular acceleration ..

Q3:- An object moves in a circular path, the angular displacement is given with $(3 - 2t^3)$;

Find angular acceleration after 1 sec.

Q4:- A ball ($m = 22$ kg) is thrown to a wall with velocity (31 m/s) and it rebounds after (0.11 sec) with velocity (18 m/s) then:

Find the force applied

Q5: An object is moving from rest and after 10 sec, it has an angular velocity (50 rad/s), if its moment of Inertia ($I = 9$ kg.m^2) ... Find it's Torque ...

Q6:- If an object is moving in constant velocity, on a circular path which radius ($r = 0.01$ m), and it's angular velocity (5 rev./sec.) then ... Find acceleration ..

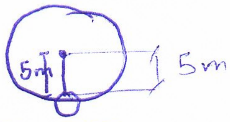
Q7:- Find I (I for one object $= \frac{ML^2}{3}$) ...

Q8 :- If an object (7 kg) is moving with velocity $(8\hat{i}+9\hat{j})$

Find it's momentum (magnitude) .....

Q9 : If an object is moving as shown (Tension = 40N) ...

Find angular velocity .... ??



Q10 : An object is moving with angular velocity (20 rad/s)

and after (5 sec) the angular velocity (12 rad/s) ...

Find angular displacement ... ?

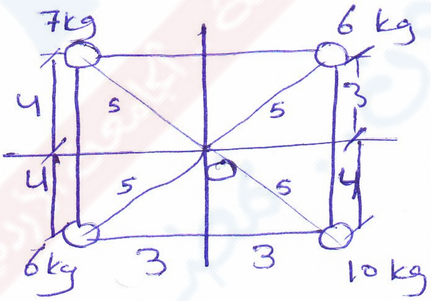
Q11 :- Two object is moving with velocities ($m_1 = 3243$, $m_2 = 1300$)

($v_1 = 49$ m/s , $v_2 = -6.5$ m/s) ....

They collide and start moving as one object ...

Find their velocity after collision ... ??

Q12 : Find I about O ...



** Solu. 1 :-

$$\Delta P = F_{avg} \cdot \Delta t$$

$$(mV_f - mV_i)$$

$$\Rightarrow 2234(0) - 2234(25) = F_{avg} * 0.26 \qquad \boxed{F_{avg} = 2.1 * 10^5}$$

** Solu. 2 :-

$$1200 \frac{rev.}{min.} * \frac{1}{60}\frac{min.}{s} * \frac{2\pi}{1 rev.} = 125.66 \ rad/s.$$

$$\omega_f = \omega_i + \alpha t$$

$$\Rightarrow 125.66 = 0 + 10.5(\alpha) \Rightarrow \boxed{\alpha = 12.0 \ rad/s^2}$$

** Solu. 3 :

$$\emptyset = 3 - 2t^3$$

$$\omega = -6t^2 \ // \ \alpha = -12t \Rightarrow \boxed{\alpha|_{t=1} = -12 \ rad/s^2}$$

** Solu. 4 :

$$\Delta P = F_{avg} \cdot \Delta t$$

$$mV_f - mV_i = F_{avg} \cdot \Delta t$$

−18 m/s ←

31 m/s →

$\Delta t = 0.11$ s.

$$22(-18-31) = F * 0.11 \Rightarrow \boxed{F = -9800 \ N}$$

** Solu. 5 :

$$\tau = I\alpha$$

$$= 9 * 5$$

$$\boxed{= 45 \ \frac{kg.m^2}{s^2}}$$

$$V_t = \omega_i + t\alpha$$

$$50 = 0 + 10\alpha$$

$$\alpha = 5 \ rad/s^2$$

** Solu. 6 :

$$v = r\omega \rightarrow \omega = 5\pi$$

$$v = 0.01 * 31.4$$

$$= 0.314 \ m/sec.$$

$$a_t = \frac{V^2}{r} = \frac{0.314^2}{0.01} = \boxed{9.86 \ m/s^2}$$

** Solu. 7 :-

$$I = I_1 + I_2$$

$$= \frac{M_1 L^2}{3} + \frac{M_2 L^2}{3} = \frac{2^2}{3}(0.8 + 0.3)$$

$$\boxed{I = 1.47 \ kg \cdot m^2}$$

** Sol. 8 : $\vec{P} = m\vec{V}$

$= 7(8\hat{i} - 9\hat{j}) = 56\hat{i} + 63\hat{j}$

$P = \sqrt{56^2 + 63^2} = 84.3 \ \frac{kg.m}{s^2}$

** Solu. 9 :

$F = \frac{Mv^2}{r}$

$40 = \frac{2 * v^2}{5}$

$r = 10 \ m/s$

$V = r * w$

$w = \frac{10}{5} = 2 \ rad/sec.$

** Solu. 10 :

$w_f = w_i + \alpha t$

$\alpha = -1.6 \ rad/s^2$

$\Delta\phi = w_i t + \frac{1}{2}\alpha t^2$

$= 20*5 - 0.5*1.6*25$

$= 80 \ rad.$

** Solu. 11 : $P_i = P_f$

$M_1V_1 + M_2V_2 = (M_1 + M_2)V_2$

$3243*49 - 1300*65 = (3243 + 1300)V_2$

$V_2 = 16.4 \ m/s$

** Solu. 12 : $I = \sum Mr^2$

$= 5^2(7 + 6 + 6 + 10) = 725 \ kg.m^2$

Good Luck

:)

University of Jordan
Physics Department
Date: 9/12/2000

First Semester 2000/2001
Time: 8.30 – 9.30

GENERAL PHYSICS 1:(0302101)
SECOND EXAM

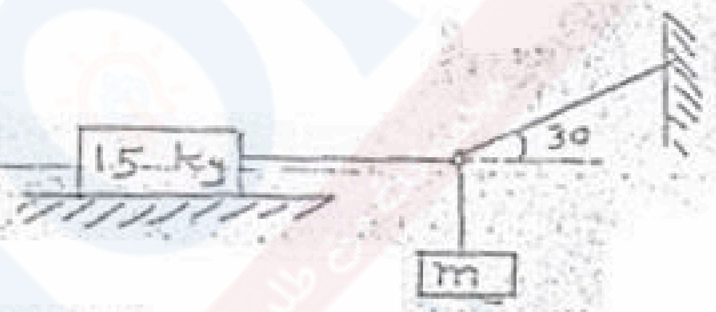
NOTE: Acceleration due to gravity, $g=9.8\ m/s^2$

الاسم باللغة العربية: ____________ الرقم الجامعي: ____________

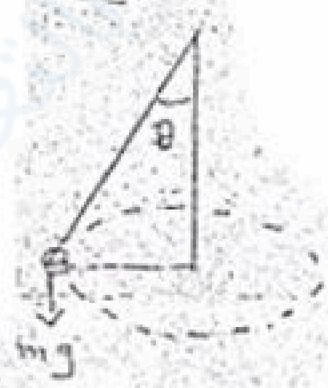
اسم المدرس: ____________ الشعبة : ____________ رقم الجلوس: ________

---

1) A 15kg block is placed on a rough horizontal surface of $\mu_s=0.3$. The block is kept in equilibrium as shown in the figure. The maximum hanging mass for which the system will remain in equilibrium is:
(a) 2.6 (b) 25.5 (c) 42.1 (d) 76.4 (e) 4.3



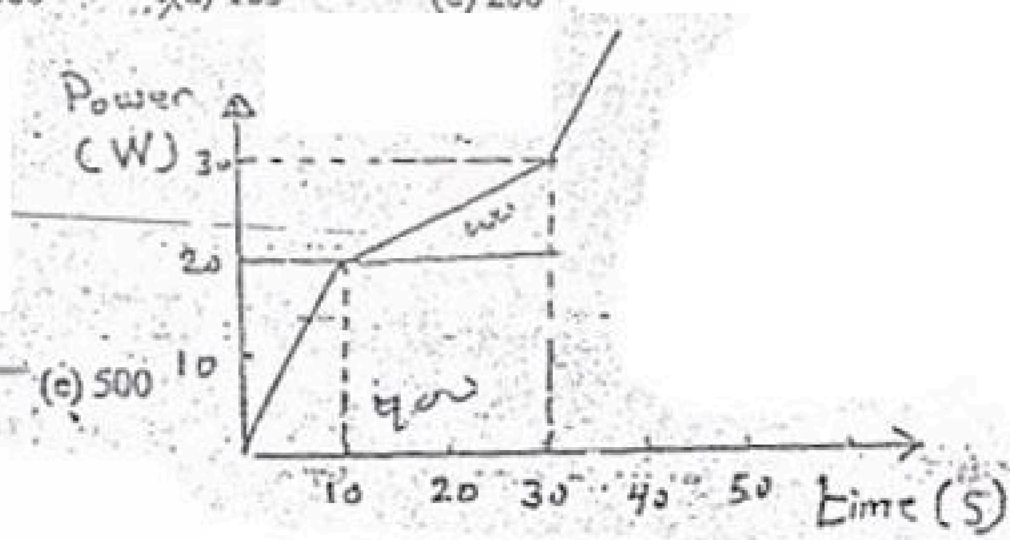
2) A conical pendulum is formed by attaching a small ball to a 1.2m string. The ball swings with uniform velocity around a horizontal circle of radius 30cm as shown in the figure. The velocity ($m.s^{-1}$) of the ball is:
(a) 11.5 (b) 0.72 (c) 0.87 (d) 3.4 (e) 0.52



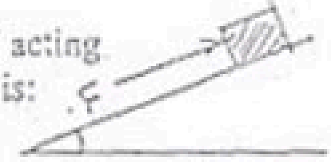
3) A 4kg particle experiences a net force along the x-axis given by $F=3x^2-6$, where F is in Newton and x is in meters. If the particle starts to move from rest at x=0, the power (w) delivered to the particle when it is at x=4m is:
(a) 168 (b) 150 (c) 476 (d) 345 (e) 188

4) A force $F=(5y^2\ N.m^{-2})\hat{j}$ is applied to a particle. The work done (J) by the force on the particle as it moves along a straight line from (2, 3) to (5, 5) is:
(a) 527 (b) 20 (c) 1466 (d) 163 (e) 200

5) This graph represents the power developed by a motor. The energy (J) expended by the motor in time interval t=10s to t=30s is:
(a) 200 (b) 100 (c) 0.5 (d) 600 (e) 500

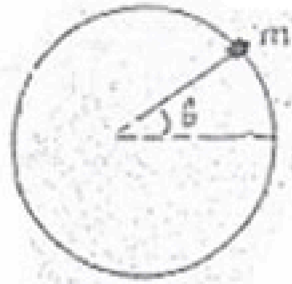


6) A 2.2 kg block placed on a frictionless 20° inclined plane. A force of 16 N acting parallel to the incline as shown the figure. The acceleration (m/s^2) of the block is:



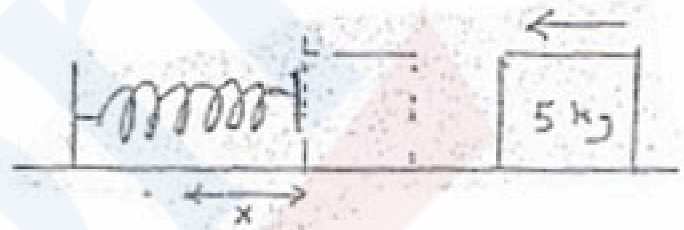
(a) 2.0 down the incline (b) 5.3 up the incline (c) 2.0 up the incline
(d) 3.9 down the incline (e) 3.9 up the incline

7) An object attached to the end of a string swings in a vertical circle (يتحرك في دائرة عمودية) of radius 1.2 m, as shown in the figure. At an instant when θ= 30°, the speed of the object is 6.0 m/s and the tension in the string is 38 N. The mass (kg) of the object is:



(a) 2.0 (b) 1.5 (c) 1.8 (d) 1.3 (e) 0.80

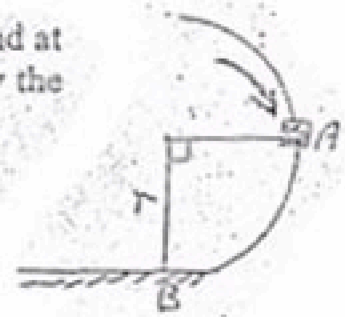
8) A block of mass 5.0 kg is moving with 3.0 m/s on a rough horizontal surface (coefficient of kinetic friction = 0.40) when it collides with a spring, as shown in the figure. The spring is compressed a maximum distance of 0.20 m. The spring constant (N/m) is:



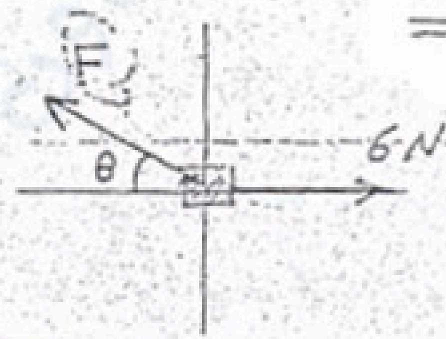
(a) 1020 (b) 1804 (c) 2196 (d) 361 (e) 929

9) A 1.2-kg mass is projected down a rough circular track (radius = 2.0 m) as shown below. The speed of the mass at point A is 3.5 m/s, and at point B, it is 6.0 m/s. How much work is done on the mass between A and B by the force of friction?

(a) −9.3 J (b) −7.3 J (c) −8.1 J (d) −10.8 J (e) −24 J



10) A 4 kg mass is placed on a rough horizontal surface. Two forces in the same plane act on the mass as shown in the figure.
The magnitude of the force F(N) that enable (تمكنه من) the 4kg mass to accelerate with $(3 m.s^{-2})\hat{j}$ is:



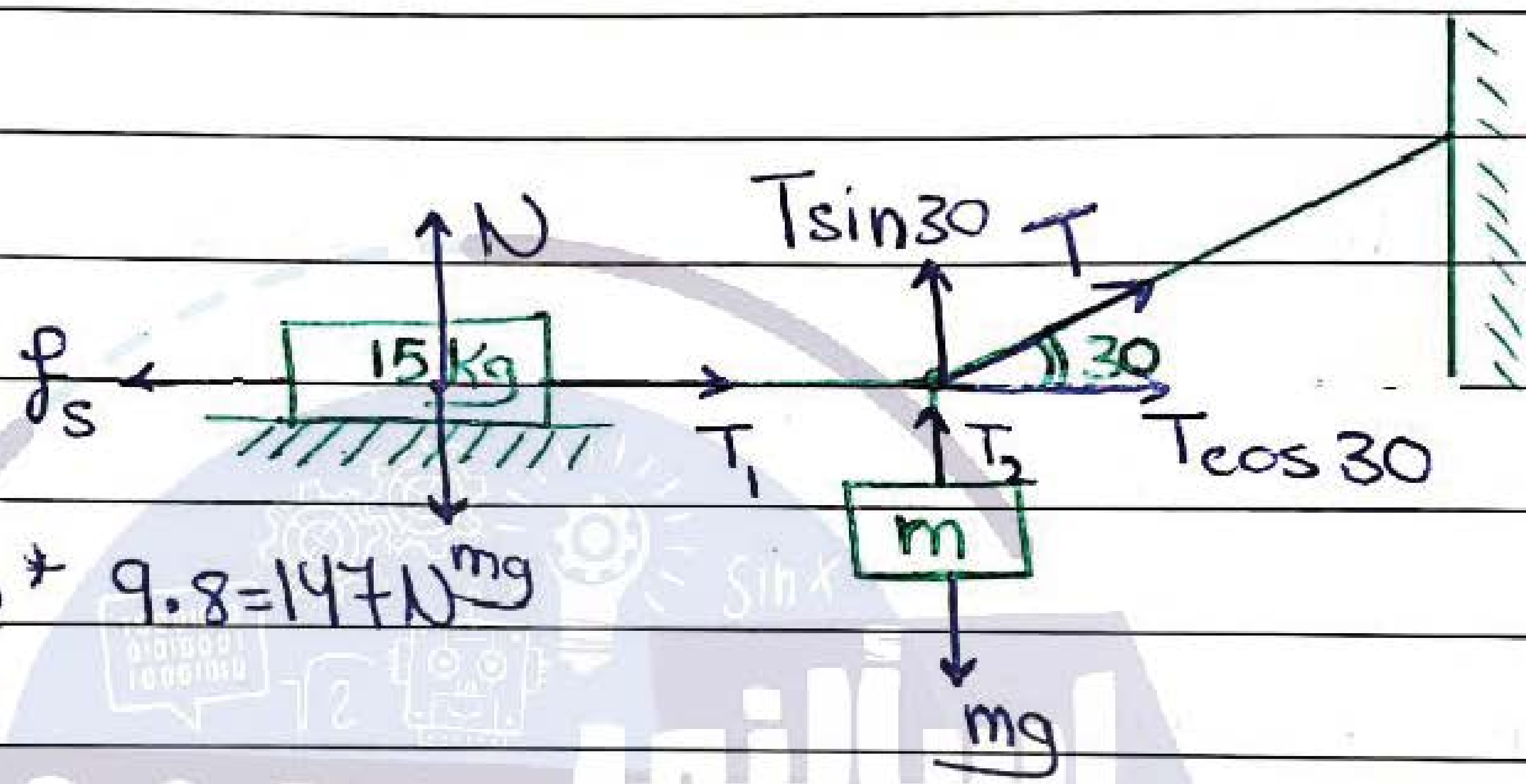
(a) 13.4 (b) 7.5 (c) 6.7 (d) 4.8 (e) 10.0

Answer Table

Q.No.	A	B	C	D	e
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

First semester (2000) - Second Exam

Q_1 :- $m_{block} = 15\ Kg$, $\mu_s = 0.3$, $m = ?$



$N = mg = 15 * 9.8 = 147\ N$

$f_s = N * \mu_s$

$= 147 * 0.3 = 44.1\ N$

$\therefore T_1 = f_s = 44.1 = T\cos 30$

$\Rightarrow T = \frac{44.1}{\cos 30} = 50.9\ N$

$\therefore mg = T_2 = T\sin 30$

$mg = 25.46$

$\boxed{m = 2.6}$

NOTEBOOK

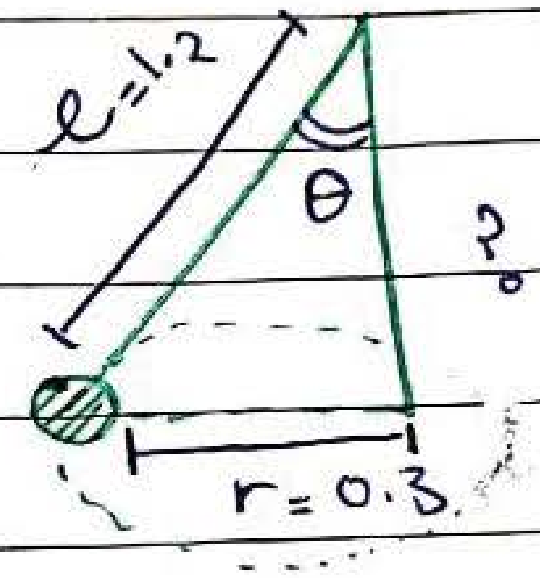
Subject Date No.

Q_2 :- $\ell = 1.2m$, $r = 0.3m$, $v = ?$

$r = \ell \sin\theta$

$= 1.2 * \frac{0.3}{1.2}$

$=$



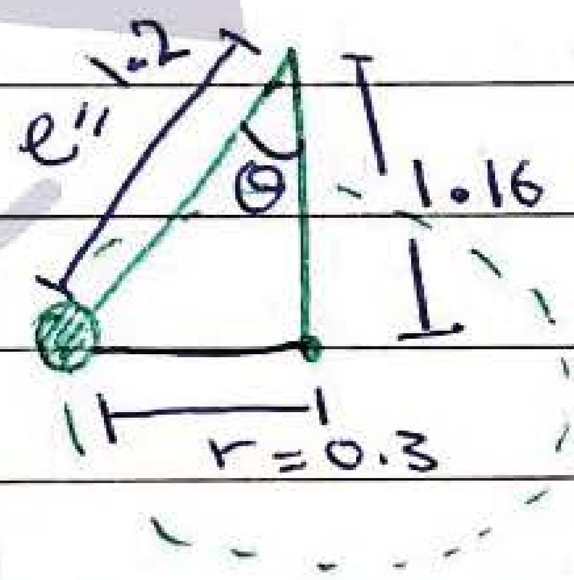
$(0.3)^2 + (x)^2 = (1.2)^2$

$x = 1.16m$

Q_2 : $\ell = 1.2m$, $r = 0.3$, $v = ?$

1. $\Sigma F_y = 0 \rightarrow T\cos\theta = mg$

$T \frac{1.16}{1.2} = mg$



$T = \frac{mg}{\cos\theta}$

تعويض

2. $\Sigma F_r = \frac{mv^2}{r}$

$T\sin\theta = \frac{mv^2}{r} \Rightarrow v = \sqrt{rg\tan\theta}$

$= 0.87 m/s$

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Subject Date No.

Q_{38} $m = 4\,Kg$, $F = 3x^2 - 6$, $P| = ?$

$v_1 = 0$ $x=0 \rightarrow x=4$

$$W = \int_0^4 F\,dx = \int_0^4 3x^2 - 6 = x^3 - 6x\Big]_0^4$$

$$= 40\,J$$

$$W = \Delta KE$$

$$= \frac{1}{2} m \left(v_f^2 - \cancel{v_i^2} \right)$$

$$40 = \frac{4}{2} v_f^2 \Rightarrow v_f = 4.47\ m/s$$

$$F\Big|_{x=4} = 3 * 16 - 6 = 42\ N$$

$$\therefore P = F \cdot v = \boxed{188}$$

Subject Date No.

Q_4:- $F = 5y^2 \hat{j}$, $(2,3) \rightarrow (5,5)$, $W = ?$

$$W = \int_3^5 F\,dy = \int_3^5 5y^2\,dy = \frac{5}{3} y^3 \Big]_3^5$$

$$= \frac{5}{3}(125-27)$$

$$= \boxed{163}$$

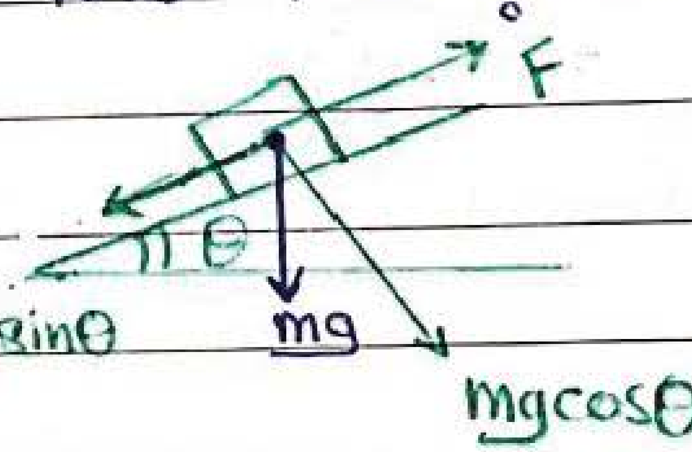
Q_5:- $t = 10s \rightarrow t = 30s$

$$W = \int_{10}^{30} P\,dt$$ (المساحة تحت المنحنى)

$$= 20 * 20 + \frac{1}{2} * 20 * 10^5$$

$$= 400 + 100 = \boxed{500}$$

Q_6:- $m = 2.2\,Kg$, $\theta = 20°$, $F = 16N$, $a = ?$



$$\Sigma F_x = ma$$

$$F - mg\sin\theta = ma$$

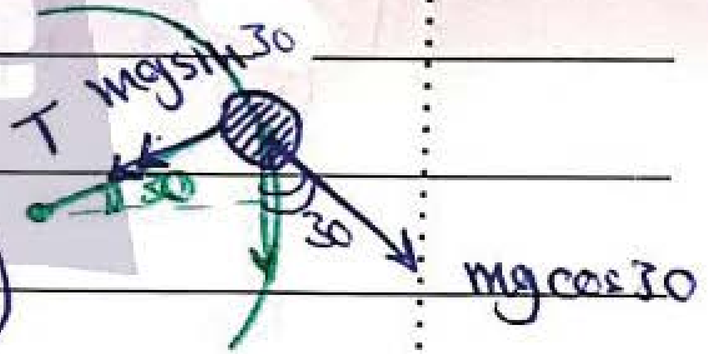
$$16 - 7.37 = 2.2a$$

$\Rightarrow a = 3.9$ up the incline

Q7:- $r = 1.2$, $\theta = 30 \rightarrow v = 6\,m/s$, $T = 38\,N$

$\sum F_r = \frac{m v^2}{r}$

$T + mg\sin 30 = \frac{m v^2}{r}$



$\Rightarrow$ ~~38 N~~ $38 = m\left(\frac{v^2}{r} - g\sin 30\right)$

$\Rightarrow$ $m = \boxed{1.5\ Kg}$

5						11					
6						12					

1. A particle of mass (11 kg) is subject to two forces such that one force has a magnitude of 21 directed east, and the other force has a magnitude of 39 N directed east-north. what is th magnitude of the particle's acceleration (in m/s^2)?

(A) 2.8 (B) 5.1 (C) 7.5 (D) 3.7 (E) 12

2. An object of mass 4.0-kg is placed on top of an elevator floor. If the force exerted by the floor o the object is equal to 38 N. What is the acceleration of the elevator (in m/s^2)?

(A) 0.8 upward (B) 0.8 downward (C) 1.3 upward (D) 1.3 downward (E) 0.3 downward

3. A force of magnitude 20N directed in the positive x direction is acting on a particle and displacin it from the point (2m, -1m) to the point (4m, -3m). What is the work done by the force (in J)?

(A) 60 (B) 40 (C) 30 (D) 80 (E) 70

4. A certain pendulum consists of a 1.5-kg mass swinging at the end of a string (length = 2.0 m). A the lowest point in the swing the tension in the string is equal to 20 N. To what maximum heig (in cm) above this lowest point will the mass rise during its oscillation?

(A) 36 (B) 20 (C) 30 (D) 28 (E) 17

5. A spring (k = 600 N/m) is placed in a vertical position with its lower end supported by horizontal surface. The upper end is compressed 20 cm, and a 4.0 kg block is placed on th compressed (مضغوط) spring. The system is then released from rest. How far above the point release will the block rise (in cm)?

(A) 20 (B) 31 (C) 10 (D) 15 (E) 25

6. A potential energy function for a two-dimensional force is of the form $U = 3x^3y$. Find the force that acts at the point (1, 1).

(A) $\vec{F} = -12\hat{i} - 3\hat{j}$ (B) $\vec{F} = -6\hat{j}$ (C) $\vec{F} = -24\hat{i} - 12\hat{j}$ (D) $\vec{F} = -6\hat{i} - 3\hat{j}$ (E) $\vec{F} = -6\hat{i}$

7. A 6.0-kg block slides along a horizontal surface. If μ_k = 0.20 for the block and surface, at what rate is the friction force doing work on the block (in W) at an instant when its speed is 4.0 m/s?

(A) -63 (B) -47 (C) +50 (D) +25 (E) -55

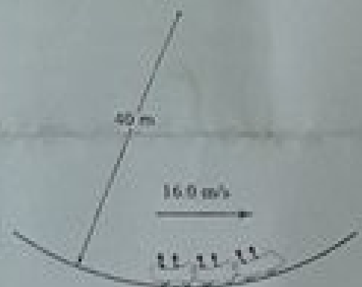
8. A particle of mass (1.5 kg) is moving on the x-axis with an acceleration given as $a = (6.0x + 5.0)\ m/s^2$. What is the speed of the particle in (m/s) at the moment it reaches x = 4.0 m, given that the particle started motion from origin with initial velocity 2.0 m/s?

(A) 10.1 (B) 14.7 (C) 11.8 (D) 13.1 (E) 9.5

9. An airplane moves at constant speed of 140 m/s as it travels around a vertical circular loop which has a 1.0-km radius. What is the magnitude of the net force causing the centripetal acceleration on the 71-kg pilot (in N)?

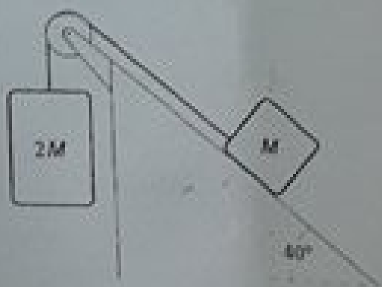
(A) 1000 (B) 1392 (C) 1200 (D) 1310 (E) 1022

10. A roller-coaster car has a mass of 400 kg when fully loaded with passengers (ركاب). At the bottom of a circular dip of radius 40 m (as shown in the figure) the car has a speed of 16 m/s. What is the magnitude of the force the track exerts on the car at the bottom of the dip (in kN)?



(A) 10.1 (B) 9.7 (C) 8.1 (D) 13.1 (E) 6.5

11. What is the magnitude of the tension in the string (in N) if M= 2.0 kg in the figure shown? Assume the surface is frictionless.



(A) 21 (B) 19.7 (C) 32.2 (D) 42.9 (E) 56.5

12. A box of mass (42 kg) is placed on top of a rough horizontal surface whose coefficients of friction are ($\mu_s = 0.6, \mu_k = 0.4$). If a man tried to push the box by applying a force of (210 N), what would be the magnitude of the friction force (in N)?

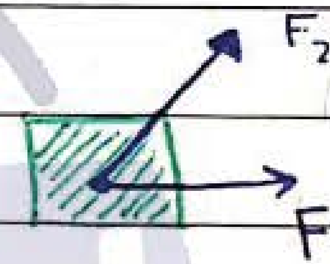
(A) 210 (B) 247 (C) 220 (D) 165 (E) 230

First semester 2015 - second Exam

Q_1: $m = 11\ Kg$, $F_1 = 21\ N,\ \hat{i}$

$F_2 = 39\ N$, east-north

$a = ?$



$$a_x = \frac{\Sigma F_x}{m} = \frac{F_1 + F_2 \cos 45}{11} = 4.42\ m/s^2,\ \hat{i}$$

$$a_y = \frac{F_2 \sin 45}{m} \Rightarrow a_y = 2.5\ m/s^2,\ \hat{j}$$

$$|a| = 5.1\ m/s^2$$

Subject Date No.

Q2 :- $m = 4\,Kg$, $F_N = 38$, $a = ?$

$$\Sigma F_y = m a_y$$

$$F_N - mg = m a_y \Rightarrow 38 - 4 * 9.8 = 4 a_y$$

$$a_y = -0.3$$

(0.3 downward)

Q3 : $F = 20N , +\hat{i}$

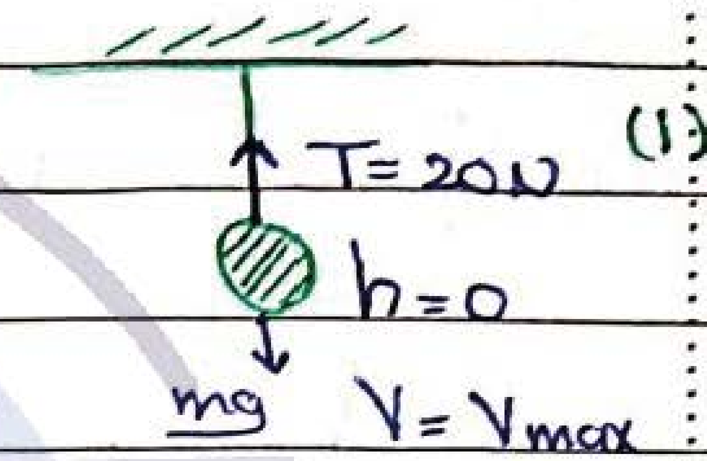
Point(1) $(2, -1)$, Point(2) $(4, -3)$

$$W = \vec{F} \cdot \vec{r}$$
$$= 20 * 2 = 40\,J$$

$$\vec{r} = Point(2) - Point(1)$$
$$= (4-2)\hat{i} + (-3+1)\hat{j}$$
$$= 2\hat{i} - 2\hat{j}$$

Subject Date No.

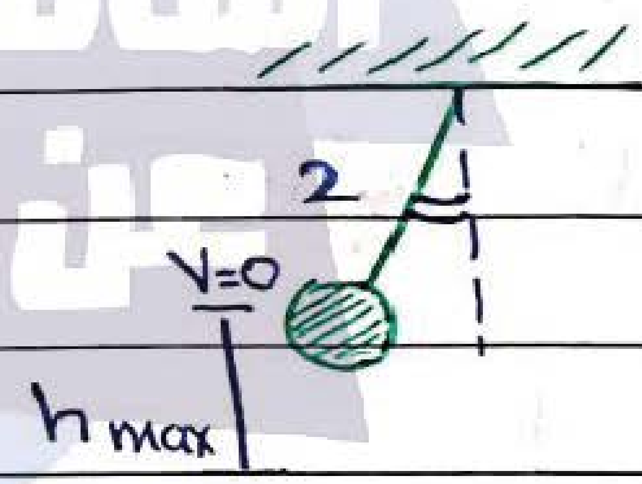
Q_4 :- $m = 1.5\ Kg$, $\ell = 2m$



$K_1 + \cancel{U_1} = \cancel{K_2} + U_2$

$\frac{1}{2} \cancel{m} V^2 = \cancel{m} g h_{max}$

$h_{max} = \frac{V^2}{2g}$



at (1) :-

$\Sigma F_y = m\ a_y$

$T - mg = m\ a_y$

$a_y = 3.53\ m/s^2$

$a = \frac{V^2}{L}$

$\therefore$ $\boxed{V = 2.657\ m/s}$

$\therefore$ $h_{max} = \frac{(2.657)^2}{2 \times 9.8} = 0.36m = 36\ cm$

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Subject Date No.

Q5: $K = 600$, $x_{max} = 0.2\,m$, $m = 4\,Kg$

$$\frac{1}{2}mv^2 + \frac{1}{2}K x_{max}^2 = mgh_{max} + \frac{1}{2}mv_2^2$$

h_{max} عند $V = zero$

x_{max} عند $V=0$

$\therefore h_{max} = 0.31\ m = 31\ cm$

Q6: $U = 3x^2y$, Point(1,1)

$$F = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j}$$

$$= (-6xy)\hat{i} - (3x^2)\hat{j}$$

$$F\Big|_{(1,1)} = -6\hat{i} - 3\hat{j}$$

Q7: $m = 6\,Kg$, $\mu_K = 0.20$, $P\Big|_{V=4} = ?$

$f_K = N * \mu_K$
$= 58.8 * 0.2$
$= 11.76\ N$

$N = mg$
$= 58.8\,N$

$P = -\vec{F}\cdot\vec{V}$
$= -47$ watt

NOTEBOOK

Q_8 :- 11.8 (C)

Q_9 :- $V = 140$, $r = 10^3\,m$, $m = 71\,Kg$

$$\Sigma F_r = \frac{m v^2}{r}$$

$$= 1392\,N$$

Q_{10} : $m = 400\,Kg$, $r = 40\,m$ $(V = 16)$, $F_N = ?$

$$F_N - mg = m a_c$$

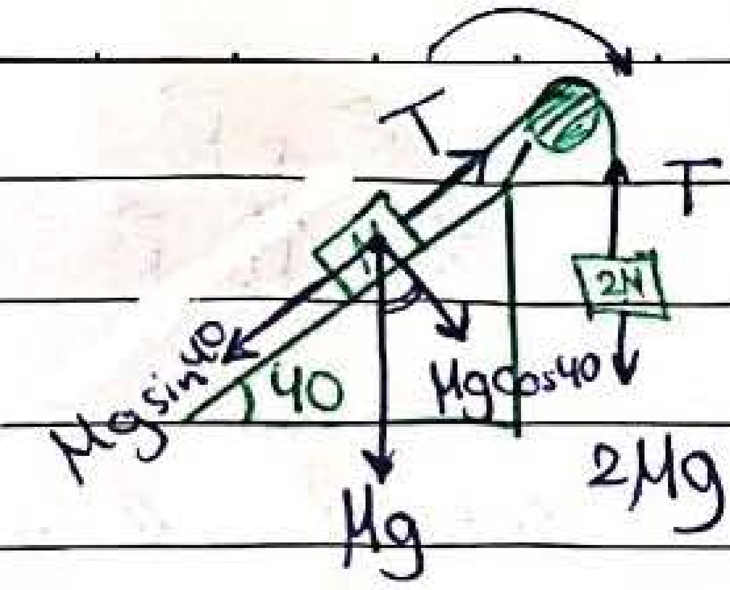
$$F_N - mg = \frac{m v^2}{r}$$

$$\therefore F_N = \frac{400\,(16)^2}{40} + 400\,(9.8)$$

$$= 6480\,N \simeq 6500\,N \simeq 6.5\,KN$$

Subject Date No.

Q_{11}: $M = 2\,Kg$



$T - Mg\sin 40 = Ma$

$T = 2a + 12.6 \rightarrow (1)$

$\Rightarrow 12.6 = T - 2a$

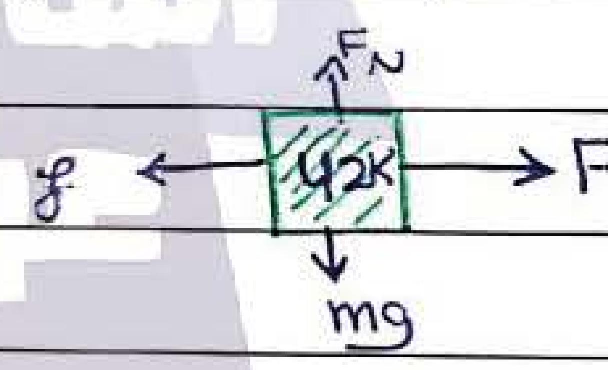
$2Mg - T = 2Ma$

$39.2 = 4a + T \rightarrow (2)$

$\therefore T = 21\,N$

Q_{12}: $m = 42\,Kg$, $\mu_s = 0.6$, $\mu_K = 0.4$, $F = 210\,N$

$f = ?$



$F_N = mg$

$= 411.6\,N$

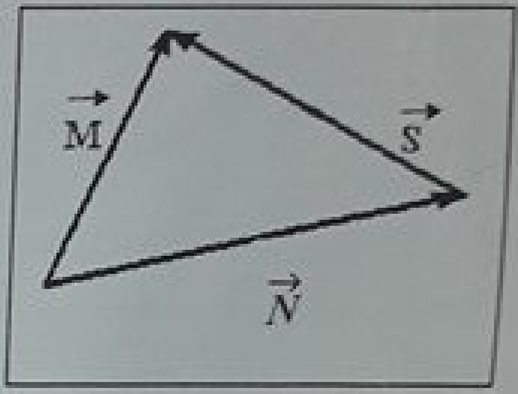
$f_s = 246.96\,N$, $f_K = 164.64\,N$

$F < f_s$ so the body will not move $(a=0)$

$F - f_s = 0 \Rightarrow f_s = F = 210\,N$

Q1: For the vectors shown in the figure, express vector $\vec{S}$ in terms of vectors $\overrightarrow{M}$ and $\vec{N}$.

A) $\overline{M} = \overline{S} - \overline{N}$
B) $\overline{S} = \overline{M} - \overline{N}$
C) $\overline{M} = \overline{N} - \overline{S}$
D) $\overline{M} + \overline{S} + \overline{N} = 0$
E) $\overline{N} = \overline{S} + \overline{M}$



Q2: An airplane undergoes the following displacements: First, it flies 66 km in a direction 30° east of north. Next, it flies 49 km due south. Finally, it flies 100 km 30° north of west. How far (in km) the airplane ends up from its starting point.

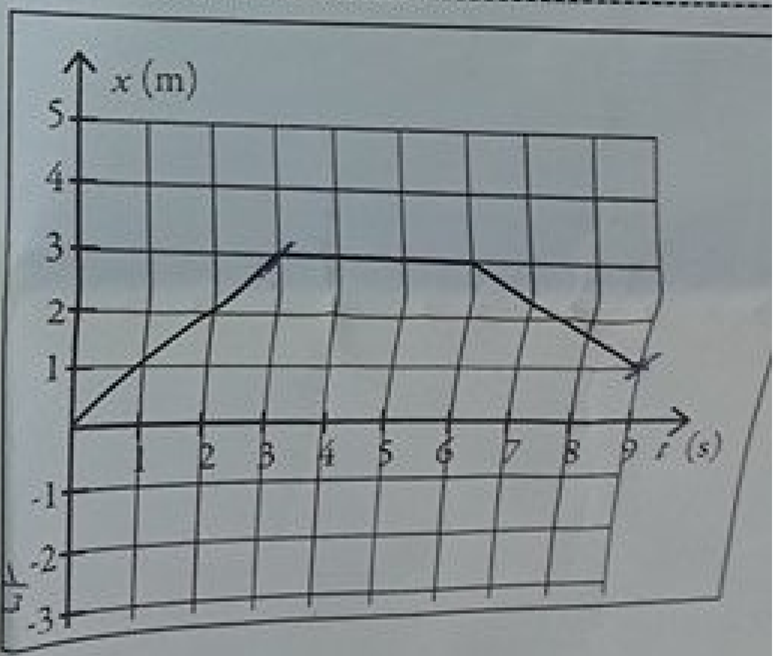
A) 79 B) 81 C) 73 D) 86 E) 93

Q3: What is the angle between the vector $\vec{A} = +3\hat{i} - 2\hat{j} - 3\hat{k}$ and the $+y$-axis?

A) 25° B) 65° C) 90° D) 115° E) 155°

Q4: The figure shows the position of an object as a function of time. What is the average velocity (in m/s) of the object during the time interval from time $t = 3.0$ s and time $t = 9.0$ s.

A) 0.33
B) -0.33
C) 0.66
D) -0.66
E) 0.99



$\Delta v = \frac{\Delta x}{\Delta t} = \frac{1-3}{9-3} = \frac{-2}{6} = -\frac{1}{3}$

Q5: The velocity of an object as a function of time is given by $v(t) = 2.00$ m/s + (3.00 m/s) t − (1.0 m/s2) t2. Determine the acceleration (in m/s^2) of the object at time $t = 5.00$ s.

A) −7.00 B) −2.00 C) 0.00 D) 2.00 E) 7.00

Q6: A car starts from rest and accelerates with a constant acceleration of 1.00 m/s^2 for $t = 3.00$ s. The car then continues for 5.00 s at constant velocity. How far (in m) has the car traveled from its starting point?

A) 4.50 B) 9.00 C) 15.0 D) 19.5 E) 25.0

Q7: A ball is thrown upward at time $t = 0.00$ s, from a point on a roof 70 m above the ground and experiences negligible air resistance. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 28.5 m/s. The velocity of the ball (in m/s) when it is 39 m above the ground is:

A) −45 B) −38 C) 38 D) 45 E) −23

Q8: An object has a position given by $\vec{r} = [2.0 \text{ m} + (5.00 \text{ m/s})t]\hat{i} + [3.0 \text{ m} - (2.00 \text{ m/s}^2)t^2]\hat{j}$, where quantities are in SI units. What is the speed (in m/s) of the object at time $t = 2.00$ s?

A) 13.0 B) 9.43 C) 7.58 D) 6.40 E) 1.42

Q9: A child throws a ball with an initial speed of 8.00 m/s at an angle of 40.0° above the horizontal. The ball leaves her hand 1.00 m above the ground and experience negligible air resistance. How far (in m) from where the child is standing does the ball hit the ground?

A) 1.67 B) 3.80 C) 5.05 D) 6.39 E) 7.46

Q10: A ball is tied to the end of a cable of negligible mass. The ball is rotated in a circle with a radius 2.00 m making 7.00 revolutions every 10.0 seconds. What is the magnitude of the acceleration of the ball (in m/s^2)?

A) 74.2 B) 67.9 C) 38.7 D) 29.3 E) 14.8

Subject Date No.

Q_1: $\vec{M} = \vec{S} + \vec{N}$

& $\vec{S} = \vec{M} - \vec{N}$

Q_2: **A**

Q_3: $\vec{A} = 3\hat{i} - 2\hat{j} - 3\hat{k}$ and y-axis

$$\cos\theta_{Ay} = \frac{A_y}{|\vec{A}|}$$

$|\vec{A}| = 4.69$

$$\cos\theta_{Ay} = \frac{-2}{4.69} \Rightarrow \theta_{Ay} = 115^\circ$$

Q_4: avg v = ? $t = 3s \rightarrow t = 9s$

$$V_{avg} = \frac{\Delta x}{\Delta t} = \frac{1-3}{9-3} = \frac{-2}{6} = \frac{-1}{3} = -0.33$$

Q_5: $v(t) = 2 + 3t - t^2$, $a(5) = ?$

$$a(t) = \frac{dv(t)}{dt}$$

$$= 3 - 2t$$

$$a(5) = 3 - 10 = -7 \ m/s^2$$

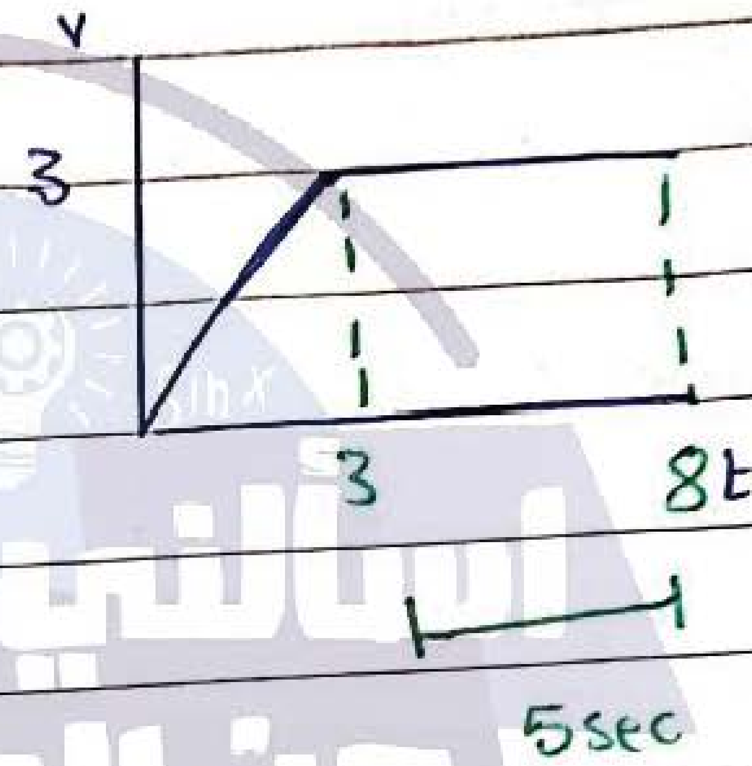
NOTEBOOK

Subject　　　　　　　　　　　　　　Date　　　　No.

Q6: $v_1 = 0$, $a = 1$, $t_1 = 3$

$t_2 = 5$

$\Delta x = ?$



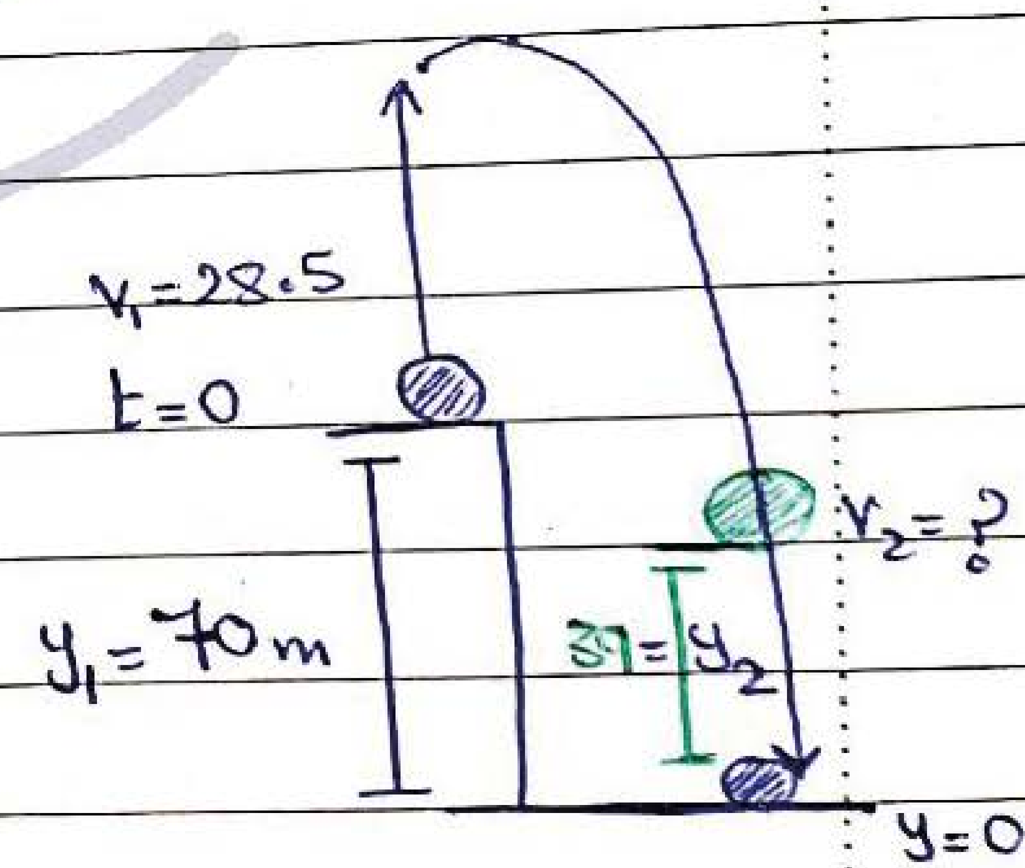
$V_2 = \cancel{V_1}^{0} + at$

$V_2 = 3\ m/s$

$\Delta x = \frac{1}{2} * 3 * 3 + 5 * 3$

$= 19.5\ m$

Q7:



$V_2^2 = V_1^2 - 2g\Delta y$

$V_2 = \pm 38$

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$\therefore V_2 = -38\ m/s$

Subject Date No.

Q8: $\vec{r} = (2+5t)\hat{i} + (3-2t^2)\hat{j}$

$x = 2+5t \quad , \quad y = 3-2t^2$

$V_x = 5 \quad , \quad V_y = -4t$

$V_x|_{t=2} = 5 \quad , \quad V_y|_{t=2} = -8$

$|\vec{V}| = \sqrt{5^2+(8)^2} = 9.43$ m/s

Q9: $V = 8\,m/s$

$V_x = 8\cos 40 = 6.128\,m/s$

$\Delta y = V_{y_1} t - \frac{1}{2} g t^2$

$-1 = 5.14t - 4.9t^2$

$4.9t^2 - 5.14t - 1 = 0$

$t = 1.22\,sec$

$\therefore \Delta x = V_x t \Rightarrow \Delta x = 7.46\,m$

N O T E B O O K

Subject Date No.

Q108: $r = 2m$, $N = 7$, $t = 10$, $a = ?$

$$V = \frac{2\pi r N}{t}$$

$$= 8.8 \, m/s$$

$$a = \frac{v^2}{r}$$

$$= 38.7 \, m/s^2$$