ARAB REPUBLIC OF EGYPT
Ministry of Education
General Secondary Education Certificate Examination, 2014
{ First Session – New System }
The applied Mathematics { Dynamics } **Time: 2 Hours**

الرياضيات التطبيقية { الديناميكا } باللغة الإنجليزية { الأسئلة فى صفحتين }

تنبيه مهم : يسلم الطالب ورقة امتحانيه باللغة العربية مع الورقة المترجمة .

Remark: 1. Calculators are allowed **2.** The acceleration of gravity g = 9.8 m/sec^2

ANSWER THE FOLLOWING QUESTIONS:

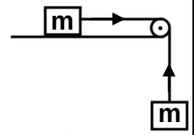
QUESTION ONE: Complete The Following Statements :{6 MARKS}

1. If a car of mass 1800 kg is moving with velocity of magnitude 100 km/h, then its momentum equals ..... kg.m/sec

2. If a body of unit mass is moving under the effect of the force $\vec{F} = (a+3)\hat{i} + b\,\hat{j}$ and its displacement vector is $\vec{S} = t^2\,\hat{i} + \frac{1}{2}\,t^2\,\hat{j}$, then: a = ... , b = ...

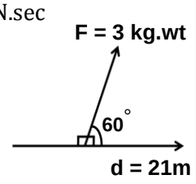
3. If a child stands on a pressure balance inside a lift moving downwards with acceleration of magnitude 1.4 m/s² and the reading of the balance is 30 kg.wt, then the child's weight = ... kg.wt.

4. In the opposite figure : The Pulley is small and smooth and the plane is smooth. If the system moves from rest, then the magnitude of its acceleration = ... g.



5. A sphere of mass 100 gm is moving horizontally with a speed of 20 m/sec. If it impinges with a vertical barrier and rebounds with a speed of 8 m/sec, then the magnitude of the impulse of the barrier on the sphere is I = ... N.sec

6. In the opposite figure : If a constant force of magnitude 3 kg.wt acts on a body in direction inclined to the horizontal upwards at an angle of measure 60° and moved it a distance of 21 meters, then the magnitude of the work done by the force = ... joule.



QUESTION TWO: {6 MARKS}

A) A force of magnitude 20 Newton acts on a body of mass 2 kg placed on a smooth horizontal table in direction making an acute angle of sine $\frac{3}{5}$ with the vertical downwards. Find the acceleration of the body as a result of this action. Find also the magnitude of the normal reaction of the table.

B) A body of mass $\frac{1}{2}$ kg is placed on a smooth plane inclined to the horizontal at an angle of measure 30°. A force of magnitude $\frac{1}{2}$ kg.wt acts on it in direction of the line of greatest slope upwards. Find the acceleration of the motion. If the force vanishes after 2 seconds, find the distance that the body ascends until it stops instantaneously.

بقية الأسئلة فى الصفحة الثانية

QUESTION THREE: {6 MARKS}

A) Two bodies of masses 200gm and 800gm move in the same straight line on a horizontal table with velocity of 4 m/s in two opposite directions. If the two bodies move after impact as one body, find the velocity after impact.

B) A car is moving with velocity 72 km/h. The force of brakes is used to stop the car. If the magnitude of this force is 10 Newton for each kg of the mass of the car, find the distance covered by the car until it came to rest

QUESTION FOUR: {6 MARKS}

A) Two bodies of masses 5 kg and 3 kg are tied to the two ends of a string that passes round a small smooth pulley. The system is kept in equilibrium with the two parts of the string hanging vertically. If the system was left to move, find the magnitude of its acceleration and the pressure on the pulley. Find also the speed of the body of mass 5 kg when it has descended a distance of 40 cm.

B) A body slides from the top of an inclined plane of length 4.5 m and height 2.7 m starting from rest, determine its speed and the time needed when it reaches the bottom of the plane given that the coefficient of friction is 0.5

QUESTION FIVE: {6 MARKS}

A) A rough plane is inclined to the horizontal at an angle of tangent $\frac{7}{24}$. A body of mass 5 kg is placed on the plane and is pulled at a uniform speed a distance of 75 cm up the plane by a force acting along the line of greatest slope. If the coefficient of the friction between the body and the plane is $\frac{5}{12}$, find:

i. The magnitude of the work done against the friction of the plane.

ii. The magnitude of the work done by the force.

B) The engine of a car works at a constant rate of 5 kilowatt and the mass of the car is 1200 kg. If the car is moving in a horizontal road against a constant resistance of magnitude 325 Newton, find:

i. The magnitude of the acceleration of the car when its speed is 8 m/sec.

ii. The maximum velocity of the car.

انتهت الأسئلة

رُوجع ومطابق للأصل الذى وُطبع على مسئولية اللجنة الفنية ،

التاريخ	التوقيع	الاسم

الدرجة العظمى (٣٠)	جمهورية مصر العربية وزارة التربيـة والتعليـم امتحان شهادة إتمام الدراسة الثانوية العامة لعام ٢٠١٤ م نموذج إجابة[الرياضيات التطبيقية(الديناميكا)بالإنجليزية]	[٢٧٣] الدور الأول (نظام حديث)
الدرجة الصغرى (ـ)		
عدد الصفحـات (٥)		

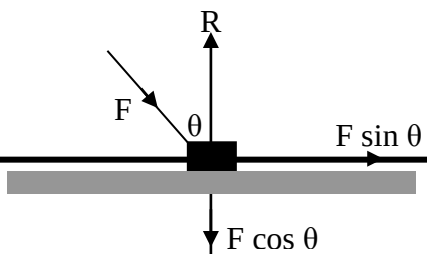
Answer of question (1) : 6 marks : 1 mark for each part

(a)	(1)	(2)	(3)	(4)	(5)	(6)
Answer	50000	a = -1 b = 1	35	$\frac{1}{2}g$	2.8	308.7
Mark	1	1	1	1	1	1

(تراعى الحلول الأخرى)

Answer of question (2) : 6 marks : (a) 3 marks and (b) 3 marks

(a) $\because$ $m\,a = F \sin\theta$ **0.5**



$\therefore\ 2a = 20 \times \frac{3}{5}$ **0.5**

$\therefore\ a = 6\ m/sec^2$ **0.5**

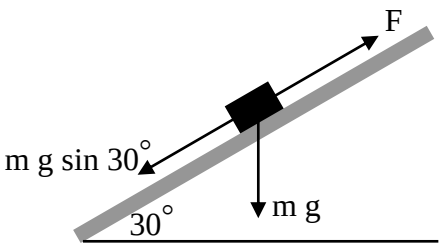
$R = F\cos\theta + m\,g$ **0.5**

$\therefore\ R = 20 \times \frac{4}{5} + 2 \times 9.8$ **0.5**

$\therefore\ R = 35.6$ **0.5**

(b) $\because F = \frac{1}{2} \times 9.8 = 4.9$ Newton

$m\,g\sin 30^\circ = \frac{1}{2} \times 9.8 \times \frac{1}{2} = 2.45$ Newton



$\therefore F > m\,g\sin 30^\circ$

$\therefore$ The motion is up the plane **0.5**

$F - m\,g\sin\theta = m\,a$ **0.5**

$\therefore\ 4.9 - 2.45 = \frac{1}{2}\,a$

$\therefore\ a = 4.9\ m/sec^2$ **0.5**

After 2 seconds :

$v = v_o + a\,t$

$\therefore\ v = 0 + 2 \times 4.9 \Rightarrow v = 9.8$ m/sec . **0.5**

$a' = -\,g\sin\theta = -9.8 \times \frac{1}{2} = -4.9\ m/sec^2$ **0.5**

$\because\ v^2 = v_o^2 + 2\,a\,s$

$0 = (9.8)^2 - 2 \times 4.9\,S$ $\therefore\ S = 9.8$ m **0.5**

(تراعى الحلول الأخرى)

Answer of question (3) : 6 marks : (a) 3 marks and (b) 3 marks

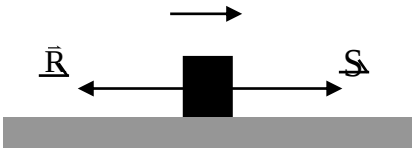
(a) $\because\ m_1 v_1 + m_2 v_2 = (m_1 + m_2)\,v'$ **1** $+\ \overrightarrow{e}$

$\therefore$ $-200 \times 4 + 800 \times 4 = 1000\ v'$ **1**

$\therefore$ $v' = 2.4$ m/sec **1**

(b) $\because$ $T - T_o = W$ **0.5**

$\therefore$ $0 - \frac{1}{2} m v_o^2 = - R\ m\ s$ where m is the mass in kg. **1**



$\therefore$ $- \frac{1}{2} \times (72 \times \frac{5}{18})^2 = - 10s$ **1**

$\therefore$ $s = 20$ m **0.5**

Another solution

$\because$ $- R = m\ a$ **0.5**

$\therefore$ $- 10\ m = m\ a$ **0.5**

$\therefore$ $a = - 10$ m/sec^2 **0.5**

$\because$ $v^2 = v_o^2 + 2\ a\ s$ **0.5**

$\therefore$ zero $= (20)^2 - 2 \times 10\ s$ **0.5**

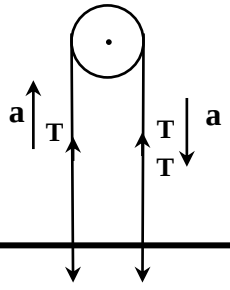
$\therefore$ $s = 20$ m **0.5**

(تراعى الحلول الأخرى)

Answer of question (4) : 6 marks : (a) 3 marks and (b) 3 marks

(a) $\because$ $5\ g - T = 5\ a$ ..... (1) **0.5**

$\therefore$ $T - 3\ g = 3\ a$ ..... (2) **0.5**



By addition

3 5

$\therefore$ 2 g = 8 a $\quad\therefore$ a = $\frac{1}{4}$ g = 2.45 m/sec^2 **0.5**

3g 5g

From (2) $\therefore$ T = 3 (g + a)

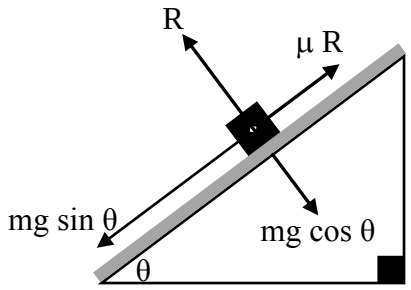
$\therefore$ T = 3 (9.8 + 2.45) $\quad\therefore$ T = 36.75 Newton **0.5**

The pressure on the pulley p = 2T = 73.5 Newton **0.5**

$\because$ $v^2 = v_o^2 + 2as$

$\therefore$ $v^2 = 0 + 2 \times 2.45 \times 0.4$ $\quad\therefore$ v = 1.4 m/sec **0.5**

(b) $\because$ mg sin θ – μR = ma …… (1) **0.5**



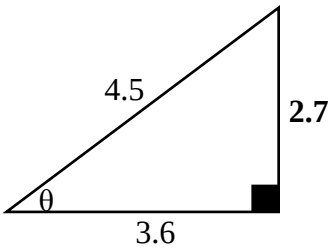
, R = mg cos θ…… (2) **0.5**

From (2) in (1) :

mg sin θ – μ mg cos θ = ma **0.5**

$\therefore$ a = $9.8 \times \frac{2.7}{4.5} - 0.5 \times 9.8 \times \frac{3.6}{4.5}$ **0.5**

$\therefore$ a = 1.96 m/sec^2



$\because$ $v^2 = v_o^2 + 2as$

$\therefore$ $v^2 = 0 + 2 \times 1.96 \times 4.5$

$\therefore$ v = 4.2 m/sec **0.5**

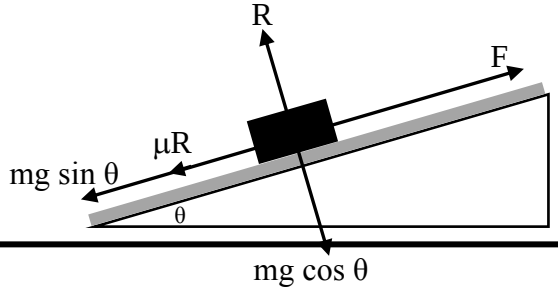
$\therefore$ $v = v_o + at$ $\quad\therefore$ 4.2 = 0 + 1.96 t $\quad\therefore$ t = $\frac{15}{7}$ sec **0.5**

(تراعى الحلول الأخرى)

Answer of question (5) : 6 marks : (a) 3 marks and (b) 3 marks

(a) (i) R = mg cos θ

$\therefore$ **R** = $5 \times 9.8 \times \frac{24}{25}$

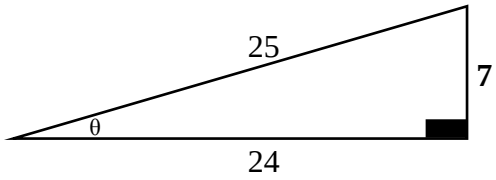


$\therefore$ **R** = 47.04 Newton **0.5**

$\therefore$ The work done against the resistance = $\mu R \times s$ **0.5**

$$= \frac{5}{12} \times 47.04 \times 0.75$$

$$= 14.7 \text{ joules}$$ **0.5**



(ii) $F = mg \sin\theta + \mu R$

$$F = 5 \times 9.8 \times \frac{7}{25} + \frac{5}{12} \times 47.04$$ **0.5**

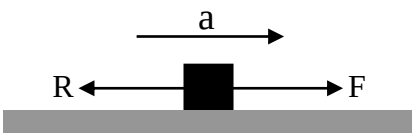
$F = 33.32$ Newton **0.5**

$\therefore$ The work done by the force = 33.32×0.75

$= 24.99$ joules **0.5**

(b) (i) Power = 5 kilowatt = 5000 watt

$\because F - R = ma$ **0.5**



$$\therefore \frac{\text{Power}}{v} - R = ma$$ **0.5**

$$\therefore \frac{5000}{8} - 325 = 1200\,a$$ **0.5** $\therefore a = \frac{1}{4}$ m/sec^2 **0.5**

(ii) At the max. speed $\Rightarrow a = 0$

$$\therefore F = R \Rightarrow \frac{5000}{v} = 325$$ **0.5**

$$\therefore v = \frac{5000}{325} = \frac{200}{13} \_ 15.4 \text{ m/sec.}$$ **0.5**

(تراعى الحلول الأخرى)

انتهى نموذج الإجابة