Jeddah University

PHYSICS (101)

Second Exam
(1439)

Mahmoud Al-Zamil

0508601922

Q.1 A car travels east at constant speed. The net force on the car is
(A) zero (B) less than zero (C) greater than zero (D) 9.8 N

Q.2 Two forces are applied to an object of mass 3 kg. One force is 18.0 N to the north and the other is 24.0 N to the south. The magnitude of the acceleration of the object is:
(A) 4.0 m/s² (B) 3.0 m/s² (C) 2.0 m/s² (D) 1.0 m/s²

Q.3 Three forces act on a particle in which it moves with constant speed, if $\vec{F}_1=(-8\,\hat{i})$N and $\vec{F}_2=(-9\hat{j})$N. Then $\vec{F}_3$ is:
(A) $(8\hat{i}+10\hat{j})$N (B) $(8\hat{i}+11\hat{j})$N (C) $(8\hat{i}+12\hat{j})$N (D) $(8\hat{i}+9\hat{j})$N

Q.4 The position of a training helicopter (weight 2.75×10^5 N) in a test is given by $\vec{r}=(0.02\ m/s^3)t^3\hat{i}+(2.2\ m/s)t\,\hat{j}-(0.06\ m/s^2)t^2\hat{k}$. Find the net force on the helicopter at t = 1.0 s.
(A) $(13.44\,\hat{i}-3.36\,\hat{k})\times10^3$ N (B) $(16.8\,\hat{i}-3.36\,\hat{k})\times10^3$ N
(C) $(3.36\,\hat{i}-3.36\,\hat{k})\times10^3$ N (D) $(6.72\,\hat{i}-3.36\,\hat{k})\times10^3$ N

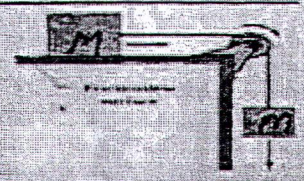
Q.5 The acceleration of gravity on the moon is 1.67 m/s². A person weighs 75 N on the moon. His mass is:
(A) 45 Kg (B) 48 Kg (C) 51 Kg (D) 57 Kg

Q.6 A man of mass 85 kg. His weight is:
(A) 735 N (B) 833 N (C) 686 N (D) 882 N

Q.7 An electron (mass = 9.11×10^{-31} kg) leaves one end of a TV picture tube with zero initial speed and travels in a straight line to the accelerating grid, which is 1.8 cm away. It reaches the grid with a speed of 3.00×10^6 m/s. If the accelerating force is constant, (ignore the gravitational force on the electron) the net force on it is:
(A) 13.7×10^{-17} N (B) 22.8×10^{-17} N (C) 27.3×10^{-17} N (D) 20.5×10^{-17} N

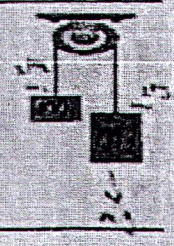
Q.8 A cable hold a ball of weight 260 N in static equilibrium. The tension in the cord is:
(A) 260N (B) 220 N (C) 280 N (D) 240 N

Q.9 In the figure, M=2.5 kg is on a horizontal frictionless surface and m=1 kg is hanging. If the tension in the cord is 7 N, the acceleration of the blocks is



(A) 4.4 m/s² (B) 3.0 m/s² (C) 2.8 m/s² (D) 3.3 m/s²

Q.10 In the figure, two blocks connected together with cord over a pulley where m_1=3 kg and m_2=4 kg. If the acceleration of the blocks is 1.4 m/s², the tension in the cord is:



(A) 26.1 N (B) 15.7 N (C) 28.0 N (D) 33.6 N

Q.11 Refer to Q10, if $m_1=m_2$=2 kg, the tension in the cord is:
(A) 39.2 N (B) 29.4 N (C) 19.6 N (D) 58.8 N

Q.12 In the figure a 11 kg box is pushed at a constant speed up the frictionless ramp by a horizontal force F. the magnitude of F is:

(A) 53.9 N (B) 34.3 N (C) 39.2 N (D) 68.6 N

Q.13 Refer to Q.12, the normal force on the box is
(A) 67.89 N (B) 59.41 N (C) 93.36 N (D) 118.8 N

Q.14 A 1400 kg car is held in place by a light cable on a very smooth ramp as shown. The cable makes an angle of 30° above the surface of the ramp, and the ramp itself rises at 25° above the horizontal. The tension in the cable is

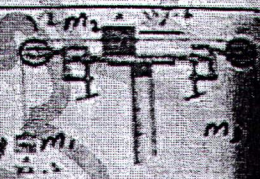
(A) 5739 N (B) 4782 N (C) 6695 N (D) 7652 N

Q.15 A1000 kg elevator is moving up with acceleration 5.5 m/s². The tension in the cable is
(A) 12300 N (B) 15300 N (C) 11300 N (D) 14300 N

Q.16 Two blocks (A and B) are in contact on a horizontal frictionless surface. A constant force F=40 N is applied to B as shown. The tension in the cord is:

(A) 23.3 N (B) 16.7 N (C) 13.3 N (D) 20 N

Q.17 Three blocks shown in figure have masses (m_1 = 4 kg, m_2 = 12 kg, and m_3). The coefficient of kinetic friction between block B and the horizontal surface is (μ = 0.25). If block B is moving to the right and with an acceleration (a = 2 m/s²). Find "m_3" the mass of block C.



(A) 12.9 kg (B) 9.6 kg (C) 22.9 kg (D) 17.1 kg

Q.18 A particle moves 10 m in the positive x direction while being acted upon by a constant force $\vec{F} = (3\hat{i} + 4\hat{k})$ N. The work done on the particle by this force is:
(A) 30 J (B) 51 J (C) 36 J (D) 45 J

Q.19 An object that has kinetic energy must be:
(A) falling (B) moving (C) at rest (D) non of these

Q.20 If you apply a constant force $\vec{F} = (-68\ N)\hat{i} + (36\ N)\hat{j}$ to a 440 kg car as the car travels 42 m in a direct that is 240° counterclockwise from the +x-axis. The work done by the force you applied on the car is:
(A) 135 J (B) 127 J (C) 113 J (D) 119 J

Q.21 A moving particle of mass 7 kg, has kinetic energy of 10 J. It speed is:
(A) 1.69 m/s (B) 2.24 m/s (C) 1.83 m/s (D) 2.00 m/s

Q.22 A man of mass 85 kg climbs a stair of 3 m height at constant speed. The work done by the man is:
(A) 2499 J (B) 6664 J (C) 1666 J (D) 4998 J

Q.23 A car moves along the x-axis with constant speed, the acceleration of the car is:
(A) Increasing (B) Decreasing (C) 9.8 m/s² (D) Zero

Q.24 A force acts on a spring with length 30 cm. This force compressed it to be 25 cm. If the spring const is 40 N/m, the work done by the spring is:
(A) -0.0375 J (B) -0.0438 J (C) -0.050 J (D) -0.563 J

Q.25 The Grand Coulee Dam is 1270 m long and 170 m high. Its electrical power output is 2000 MW. If 8 of the work done on the water by gravity is converted to electrical energy. If the water density = 1000 kg The cubic meters of water which, flow from the dam top per second to produce this power are:
(A) $V=1.4\times10^3\ m^3$ (B) $V=1.3\times10^3\ m^3$ (C) $V=2.11\times10^3\ m^3$ (D) $V=6.54\times10^2\ m^3$

11434 ①

① constant speed net force = 0

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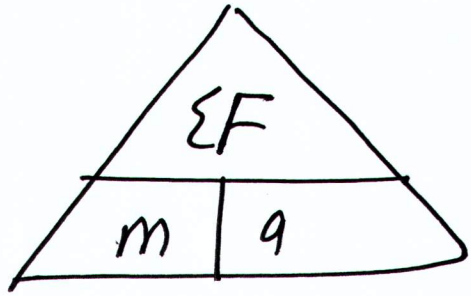
② $m = 3$ kg

$F_1 = 18j$ (North)

$F_2 = -24j$ (South)

$$a = \frac{\Sigma F}{m}$$



$$a = \frac{18j - 24j}{3}$$

$$a = \frac{-6j}{3} = -2j$$

$|a| = \sqrt{2^2} = 2 \ m/s^2$ (c)

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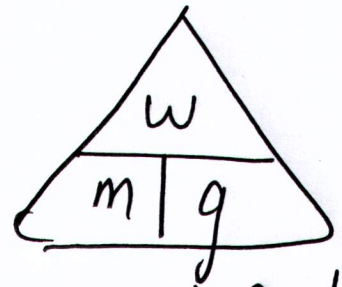
③ constant speed $\Sigma F = 0$

$F_1 + F_2 + F_3 = 0$

$-8i - 9j + F_3 = 0$

$F_3 = 8i + 9j$ (d)

$$m = \frac{w}{g}$$



$$m = \frac{2.75 \times 10^5}{9.8} = 28061.2 \text{ kg}$$

$$\vec{r} = 0.02t^3 i + 2.2t j - 0.06t^2 k$$

$$V = 0.06t^2 i + 2.2j - 0.012k$$

$$a = 0.012t i - 0.012k$$

at $t = 1$ $\quad a = 0.012 i - 0.012k$

$$\boxed{\Sigma F = m \times a}$$

$$\Sigma F = 28061.2(0.012i - 0.012k)$$

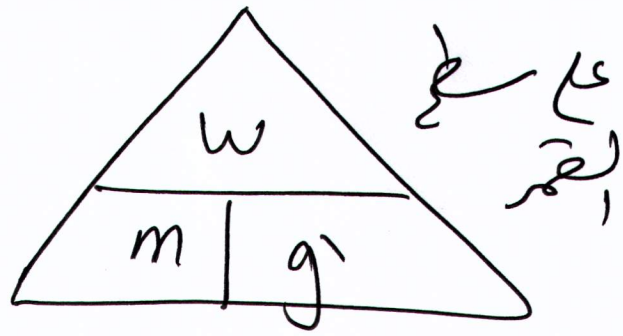
$$\Sigma F = 336.73 i - 336.73 j \ N$$

⑤

$$m = \frac{w}{g}$$

$$m = \frac{75}{1.67}$$

$m = 45$ kg (a)



على سطح القمر

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⑥ $w = mg$

$w = 85 \times 9.8$ $\quad w = 833$ N (B)

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⑦ $v_0 = 0$

$x = \frac{1.8}{100} = 0.018$ m

$v = 3 \times 10^5$ m/s

$v^2 = v_0^2 + 2ax$

$(3 \times 10^5)^2 = 0 + 2 \times a \times 0.018$

$a = 2.5 \times 10^{12}$ m/s²

$\Sigma F = m \times a$

$= 9.11 \times 10^{-31} \times 2.5 \times 10^{12}$

$a = 22.7 \times 10^{-17}$ m/s²

(B)

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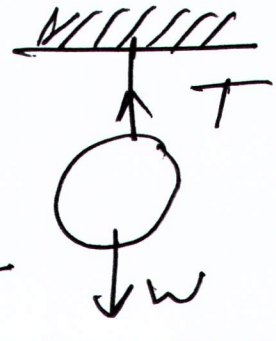
⑧ $T = w$

$T = 260$ N

(a)



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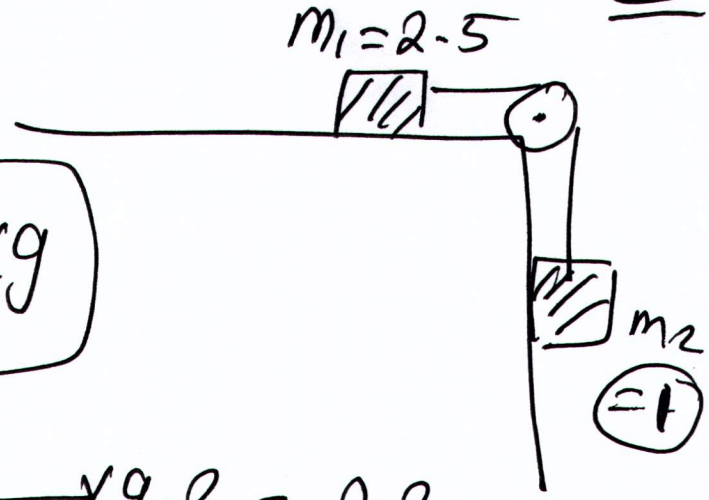
(9)



$$a = \frac{m_2}{m_2 + m_1} \times g$$

$$a = \frac{1}{1 + 2.5} \times 9.8 = 2.8$$

(c)

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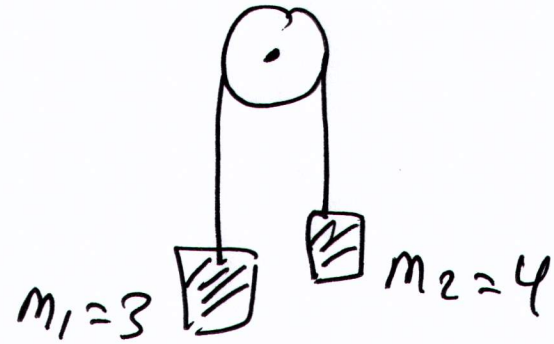
(10)

$$T = m_1(g + a)$$



$$T = 3(9.8 + 1.4)$$

$$= 33.6 \quad N$$

(d)

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(11)

$$a = \frac{m_2 - m_1}{m_2 + m_1} \times g \quad \Big| \quad a = \frac{2 - 2}{2 + 2} \times 9.8$$

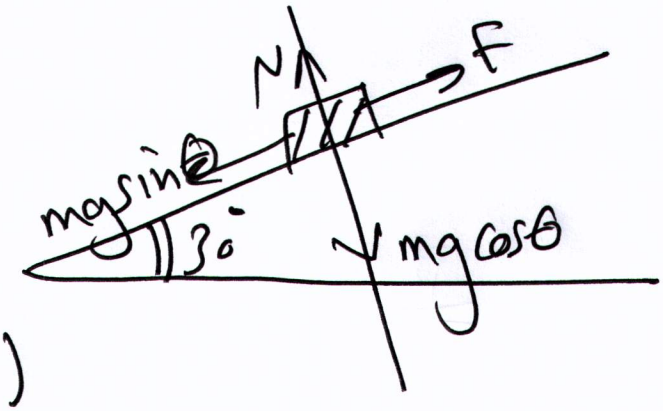
$$a = 0 \quad m/s^2$$

$$T = m_1(g + a)$$

$$T = 2(9.8 + 0) = 19.6 \quad N$$

(c)

(12) constant speed



$F = mg\sin\theta$

$= 11 \times 9.8 \sin(30)$

$= 53.9 \quad N$ (a)

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(13) $N = mg\cos(\theta)$

$N = 11 \times 9.8 \cos(30)$

$= 93.35 \quad N$ (c)

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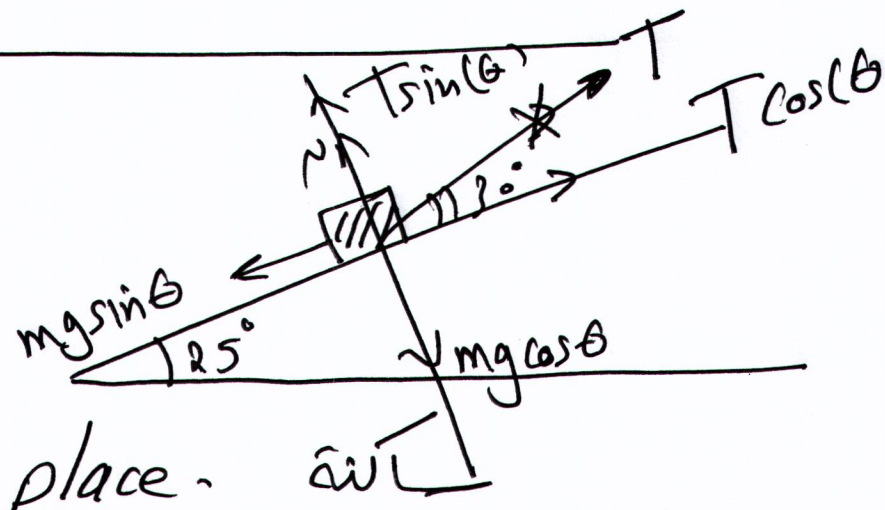
(14)



* held in place. ثابت

(1) قانون نيوتن

$T\cos(30) = mg\sin(25)$

$T\cos(30) = 1400 \times 9.8 \sin(25)$

$T = 6695 \quad N$

(c)

(15) ere elevator (up)

$$T = m(g+a)$$

$$T = 1000(9.8+5.5)$$

$$T = 15300\ N$$ (B)

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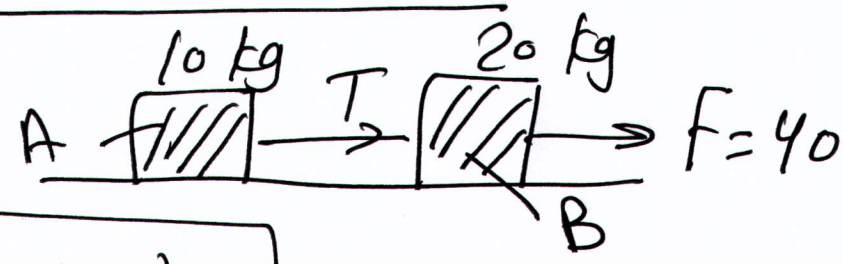
(16)



$$F = (m_1 + m_2)a$$

$$40 = (20+10)a \qquad a = \frac{40}{30} = 1.33\ m/s^2$$

$$T = m_A \cdot a \qquad T = 10 \times 1.33 = 13.3\ N$$

(e)

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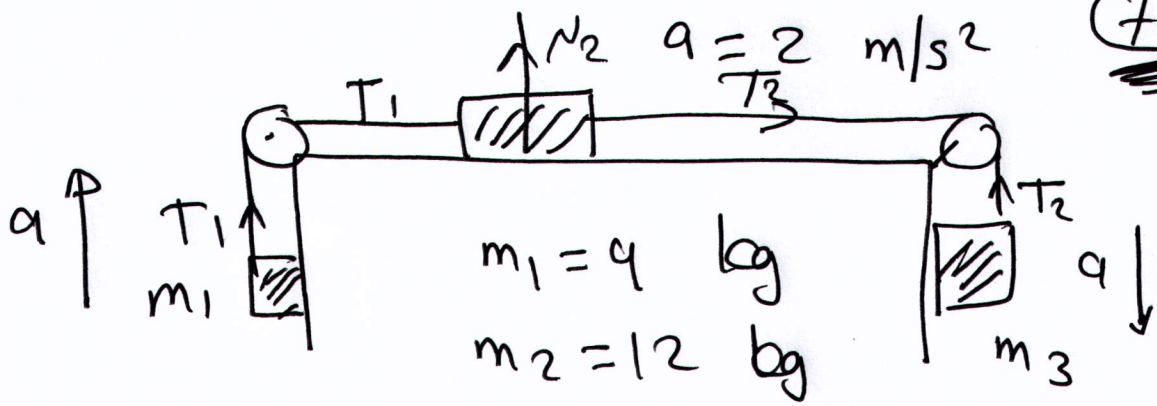
(18) $w = F \cdot d$ $\qquad d = 10i$

$$w = (3i+4k) \cdot 10i$$

$$w = 30\ J$$ (A)

(17)



(7)

* for m_1:

$$\boxed{T_1 = m_1(g+a)}$$

$$T_1 = 4(9.8+2)$$

$$T_1 = 47.2\ N$$

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* for m_2:

$$N_2 = m_2 g$$

$$N_2 = 12 \times 9.8 = 117.6\ N$$

$$f_k = \mu_k \times N_2$$

$$= 0.25 \times 117.6 = 29.4\ N$$

* قانون نيوتن ② على الجسم 2

$$\boxed{\Sigma F = m_2 a}$$

$$T_2 - T_1 - f_k = m_2 a$$

$$T_2 - 47.2 - 29.4 = 12 \times 2$$

$$T_2 = 100.6\ N$$

* for m_3

قانون نيوتن (٣)

$$m_3 g - T_2 = m_3 a$$

$$9.8\, m_3 - 100.6 = 2\, m_3$$

$$m_3 = 12.897 \text{ kg}$$

(19) (9)

kinetic energy ⟶ moving تحرك

(B)

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(20)

240°

الربع الثالث

$d = 42\cos(240)\,i + 42\sin(240)\,j$

$d = -21\,i + 36.4\,j$

$F = -68\,i + 36\,j$

$d = -21i - 36.4j$

$w = 1428 - 1310.4 = 119 \text{ J}$

(d)

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(21)

$K = \frac{1}{2}mv^2$

$10 = \frac{1}{2} \times 7 \times v^2$

$v = 1.69 \text{ m/s}$ (a)

22

$m = 85 \ kg$

$d = 3 \ m$

$W = mgd$

$W = 85 \times 9.8 \times 3$

$W = 2499 \ J$

a

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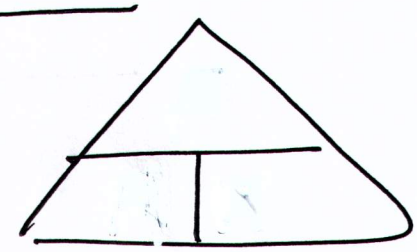
23 constant speed يتحرك بـ

$a = 0$

d

24

$$W = -\frac{1}{2} k (\Delta x)^2$$



$W = -\frac{1}{2} \times 40 (0.05)^2$

$W = -0.05 \ J$

c

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25 $P = 2000\ Hw = 2000 \times 10^6$ watt

$t = 1\ s$

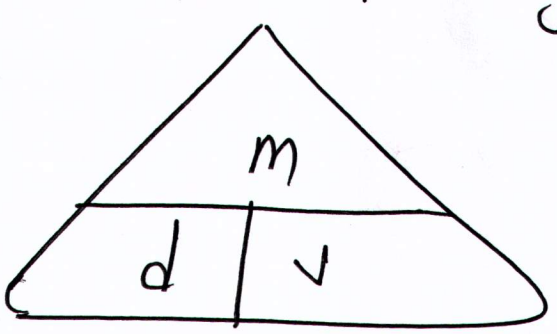
بما أن $W_{eff} = P \cdot t = 2000 \times 10^6 \times 1 = 2 \times 10^9\ J$

$$W = \frac{2 \times 10^9}{0.8} = 2.5 \times 10^9\ J$$

$$\boxed{W = mgd}$$

$$m = \frac{W}{gd} = \frac{2.5 \times 10^9}{9.8 \times 170}$$

$$m = 1.41 \times 10^6\ kg$$



$$V = \frac{m}{d} \qquad V = \frac{1.41 \times 10^6}{1000}$$

$$V = 1.41 \times 10^3\ m^3$$