Arab Republic of Egypt **Subject: Statics**

Ministry of Education **Time Allowed: Two Hours**

Experimental Model Test for third secondary stage 2017/2018

(1) A body is placed on an rough plane inclined to the horizontal at an angle of measure θ .

and λ is the measure of the angle of friction. If the body is about to slide down, then ……

(a) $\theta > \lambda$ (b) $\theta = \lambda$ (c) $\theta < \lambda$ (d) $\theta = 2\ \lambda$

(2) If the force $\vec{F} = (2, -3, 4)$ acts at the point (1 , 1 , 1) ,then the component of the moment of $\vec{F}$ about the x – axis is ……..

(a)7 (b) 2 (c) -2 (d) -5

(3) Answer one of the following items:

a) If the two forces $\vec{F}_1 = k\hat{\imath} + \hat{\jmath}$, $\vec{F}_2 = 8\hat{\imath} - 4\hat{\jmath}$ act at the two points A(-2 , 0) and B (4 , 0) respectively, determine the value of k and the equation of line action of the resultant of the two forces.

b) If $\vec{F}_1 = 4\hat{\imath} - 3\hat{\jmath}$ is one of a two forces of a couple and its line of action passes through the point A (5 , 2) , the line of action of the second force $\vec{F}_2$ passes through the point B (1 , -4), find $\vec{F}_2$ and the magnitude of the moment of the couple and determine the length of its arm.

(4) ABCD is a square of side length 8 cm . Forces of magnitudes 2 , 5 , F , 6 $\sqrt{2}$, 8 $\sqrt{2}$ gm.wt act along $\overrightarrow{AB}$, $\overrightarrow{CB}$, $\overrightarrow{CD}$, $\overrightarrow{AD}$, $\overrightarrow{AC}$, $\overrightarrow{DB}$ respectively. If the line of action of the resultant of these forces is parallel to $\overleftrightarrow{AC}$, find the value of F

(5) A body of weight W newton is placed on a rough plane inclined to the horizontal at an angle of measure θ^0 ,it is found that the least force acting on the body along the line of greatest slope which makes the body is about to move upward equals W newton. Find the measure of the angle of frication and the magnitude of the resultant reaction force.

(6) If $\vec{F}_1 \;//\; \vec{F}_2$, $\|\vec{F}_1\| = 5$ newton, $\|\vec{R}\| = 3$ newton then $F_2 \in$ .....

(a) {2} (b) {8} (c) {2 , 8} (d) {3 , 5}

(7) If $\vec{M}_1$, $\vec{M}_2$ are two equilibrium couples, $\vec{M}_1 = 10\ \vec{c}$, then $\vec{M}_1 - \vec{M}_2$=.....

(a) zero (b) $\vec{0}$ (c) $-20\ \vec{c}$ (d) $20\ \vec{c}$

(8) $\overline{AB}$ is a non-uniform rod rests in a horizontal position on two supports at C and D such that AC = CD = DB . If the rode is about to rotate when a weight of magnitude 4 newton is suspended from A or a weight of magnitude 8 newton is suspended from B . Find the weight of the rod and prove that the point of its action divides $\overline{AB}$ at the ratio 4 : 5

(9) The center of gravity of a uniform fine lamina in a form of an equilateral triangle of side length 12 cm lies at …… cm from one of the vertices of the triangle .

(a) 6 (b) $2\sqrt{3}$ (c) $4\sqrt{3}$ (d) $6\sqrt{3}$

(10) If the force $\vec{F}_1 = m\vec{\imath} + 2\vec{\jmath}$ acts at the point A(6 , 3) and its moment vector about the origin = 9 $\vec{k}$, then m =.....

(a) 9 (b) 6 (c) 3 (d) 2

(11) Find the center of gravity of the following distribution : W_1 = 20 newton, acts at (4, 1)

W_2= 15 newton acts at (-3 , 1) , W_3 = 25 newton acts at (1, 1)

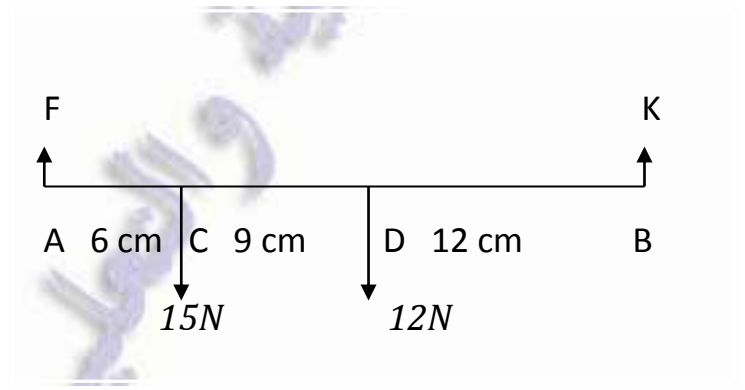
(12) ABCD is a rectangle in which AB = 6 cm , BC = 8 cm . Forces of magnitudes 13 , 5 , 4 , 7 and 15 newton act along $\overrightarrow{AB}$, $\overrightarrow{CB}$, $\overrightarrow{CD}$, $\overrightarrow{AD}$, $\overrightarrow{CA}$ respectively,. Prove that this system of forces is equivalent to a couple and calculate the norm of its moment.

(13) A body of weight 12 kg.wt , is placed on a horizontal rough plane , two perpendicular forces of magnitudes 6 , F kg.wt acted on the body . If the body is about to move when the measure of the angle of friction between the body and the plane equals 30^{o} ,find the coefficient of the static fraction between the body and the plane and the magnitude of the force F

(14) In the opposite figure

If $\overline{AB}$ is an equilibrium horizontal rod , then F – K =…….newton

(a)7 (b)10 (c)17 (d)27



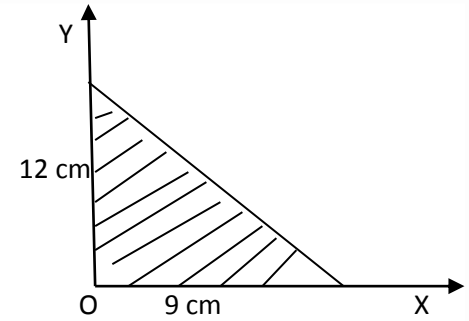
(15) Answer one of the following items:

(a) If the moment of the force $\vec{F} = 2\hat{\imath} + 3\hat{\jmath} - \hat{k}$ that acts on the point (m , 2 , k) about the origin point equals $-5\hat{\imath} + 2\hat{\jmath} - \hat{k}$, find the value of each of m and k.

(b) ABC is an isosceles triangle in which $m(\angle A) = 120^o$.Forces of magnitudes 2 , $2\sqrt{3}$ and 2 newton act along $\overrightarrow{AB}$, $\overrightarrow{BC}$, $\overrightarrow{AC}$ respectively .Prove that the line of action of the resultant of these forces passes through the midpoint of $\overline{BC}$ and parallel to $\overline{AC}$ (using moments)

(16) $\overline{AB}$ is a uniform rod of weight 40 newton rests at one of its ends against a vertical wall , the coefficient of friction between it and the wall equals $\frac{1}{2}$ and rests with its other end on a horizontal ground , the coefficient of friction between it and the ground equals $\frac{1}{3}$. If the least horizontal force acts at B that makes the end B is about to move towards the wall equals 60 newton, then find measure of inclination angle of the rod to the horizontal. (The rod is equilibrium in a vertical plane)

(17) In the opposite figure:



The center of gravity of the shaded lamina is …….

(a) (3,4) (b) (4,3) (c) (6,8) (d) (8,6)

(18) A uniform rod is attached to a fixed hinge on a vertical wall. R_1 , R_2 are the two algebraic component of the reaction force of the hinge to the rod. If R_1 = 5 newton, R_2 = $5\sqrt{3}$ newton, then the magnitude of the reaction of the hinge to the rod equals …… newton.

(a) $\sqrt{3}$ (b) $5\sqrt{3}$ (c) $10\sqrt{3}$ (d) 10