A A A

Name Surname: **Student No:** **Duration: 100 minutes** **26.11.2022**

In the one-dimensional motion of a point particle, the position equation is defined by $x = At^2 + Bt + C$ where x in meters and t in seconds. Based on this information, answer the following two questions (1-2).

1) In which option are the dimensions of constants A, B and C given correctly?

a) $[A]=[L][T]^{-2}$, $[B]=[L][T]$, $[C]=[L]$

b) $[A]=[L][T]^{-2}$, $[B]=[L][T]^{-1}$, $[C]=[L]$

c) $[A]=[L][T]^{-2}$, $[B]=[L][T]$, $[C]=$ Dimensionless

d) $[A]=[L][T]^{-1}$, $[B]=[L]^{-2}$, $[C]=[L][T]^{2}$

e) $[A]=[L][T]^{-1}$, $[B]=[L][T]^{-2}$, $[C]=[L]$

2) For this particle, which started its motion from the origin at t=0, its position, speed and acceleration in the 5th second were measured as 38 (m), 12 (m/s) and 2 (m/s^2), respectively. In this case, in which option are the values of constants A, B and C given correctly?

a) $A=1$, $B=2$, $C=-3$

b) $A=-1$, $B=-2$, $C=4$

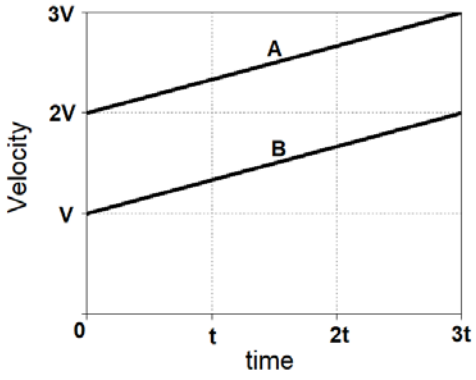
c) $A=-2$, $B=1$, $C=3$

d) $A=0.5$, $B=2$, $C=4$

e) $A=1$, $B=2$, $C=3$

---

3) The velocity-time graphs of vehicles A and B, which are side by side at the beginning, are as in the figure.
Based on this, which of the following statements are correct?



I) Vehicle A is increasing its speed relative to vehicle B.
II) The distance between vehicles A and B is continuously increasing.
III) The accelerations of the vehicles are equal.

a) Only I b) I and II c) I and III
d) II and III e) I, II, and III

Vehicles A and B accelerate with accelerations of $\vec{a}_A = \hat{i} + 3\hat{j}$ (m/s^2) and $\vec{a}_B = 3\hat{i} - 2\hat{j}$ (m/s^2), respectively. Both vehicles started from rest from the origin of the xy-coordinate system.

Based on this information, answer the following three questions (4-6).

4) At t=2 (s), which of the following is the velocity vector of vehicle A with respect to vehicle B in (m/s) unit?

a) $8\hat{i} + 2\hat{j}$ b) $2\hat{i} - 5\hat{j}$ c) $-4\hat{i} + 10\hat{j}$ d) $4\hat{i} - 10\hat{j}$ e) $-2\hat{i} + 5\hat{j}$

5) At t=2 (s), what is the distance between vehicles A and B in (m) unit?

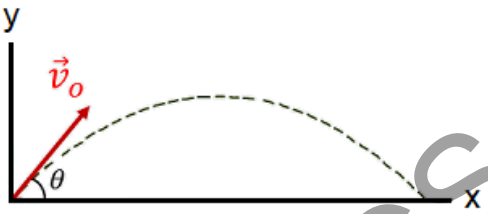
a) $\sqrt{116}$ b) $\sqrt{68}$ c) 10 d) $2\sqrt{10}$ e) $\sqrt{102}$

YTU DEPARTMENT OF PHYSICS

6) At t=2 (s), which of the following is the acceleration vector of vehicle B with respect to vehicle A in (m/s^2) unit?

a) $8\hat{i}+2\hat{j}$ b) $2\hat{i}-5\hat{j}$ c) $-4\hat{i}+10\hat{j}$ d) $4\hat{i}-10\hat{j}$ e) $-2\hat{i}+5\hat{j}$

In a football match, one of the players hits the ball on the ground with a speed of $v_0 = 25$ m/s at an angle of θ=37^o with the horizontal as shown in the figure. Consider the point where the ball was hit as the origin (0;0) and ignore any kind of friction. Based on this information, answer the following two questions (7-8). (g=10 (m/s^2), sin37^o=0.6 ve cos37^o=0.8)



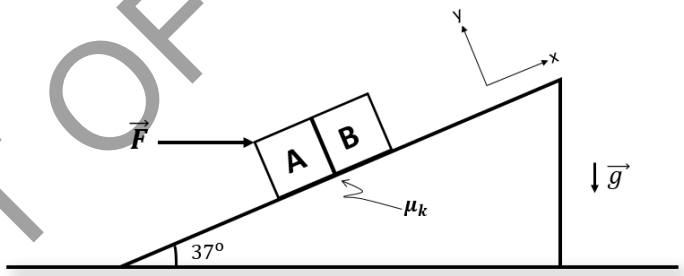
7) Imagine that there is another football player running at a constant velocity from the point (45;0) (m) when the player hits the ball. What is the constant velocity vector in (m/s) unit that this player must run to catch the ball exactly where it hits the ground?

a) $\hat{i}$ b) $2\hat{i}$ c) $3\hat{i}$ d) $4\hat{i}$ e) $5i$

8) What is the position vector in (m) unit relative to the origin at the moment when the ball reaches its highest point?

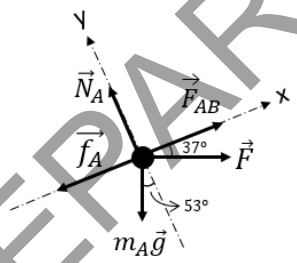
a) $30\hat{i}+11.25\hat{j}$ b) $15\hat{i}+22.5\hat{j}$ c) $30\hat{i}+22.5\hat{j}$ d) $22.5\hat{i}+30\hat{j}$ e) $25\hat{i}+15\hat{j}$

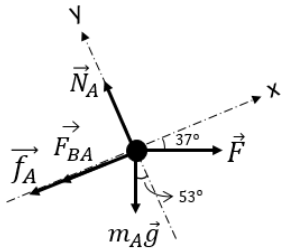
Blocks A and B are in contact with each other on an inclined plane with an inclination angle of 37^o as shown in the figure. The masses of the blocks are m_A= 2 (kg) and m_B=2 (kg). The coefficient of kinetic friction between the blocks and the surface of the inclined plane is 0.5. A force $\vec{F}$ which is parallel to the ground is applied to block A as shown in the figure, and the blocks rise with a constant velocity up to the top of the inclined plane. Based on this information, answer the following three questions (9-11).

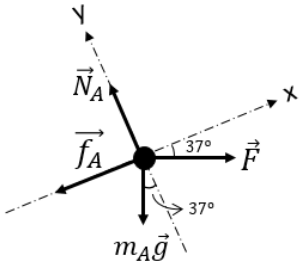


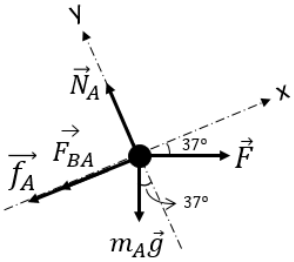
(g=10 (m/s^2), sin37^o=0.6 ve cos37^o=0.8)

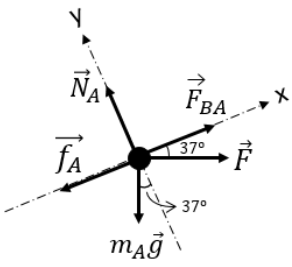
9) Which of the following options is the free body diagram of block A given correctly?

a)


b)


c)


d)


e)


YTU DEPARTMENT OF PHYSICS

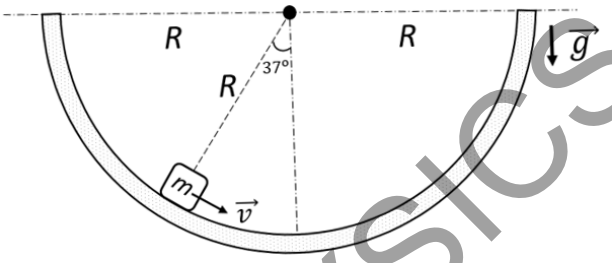
10) What is the magnitude of the force $\vec{F}$ in (N) unit?

a) 72 b) 56 c) 80 d) 24 e) 64

11) What is the force of kinetic friction acting on block A in (N) unit?

a) 48 b) 36 c) 32 d) 24 e) 16

A block of mass m=0.1 (kg) moves on a circular frictionless path of radius R=0.5 (m). As shown in the figure, the speed of the object at θ=37° is v=4 (m/s). Based on this information, answer the following two questions (12-13).
(g=10 (m/s^2), sin37°=0.6 and cos37°=0.8)



12) In which option are the tangential and centripetal accelerations in (m/s^2) unit of the object given correctly?

a) $a_r = 32$, $a_t = 6$ b) $a_r = 32$, $a_t = 8$ c) $a_r = 8$, $a_t = 32$ d) $a_r = 16$, $a_t = 10$ e) $a_r = 16$, $a_t = 12$

13) What is the magnitude of the normal force in (N) unit?

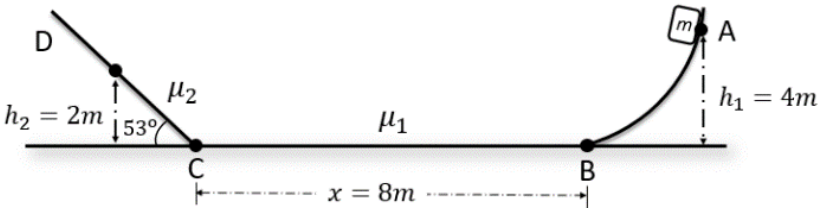
a) 2 b) 1.8 c) 3.6 d) 2.4 e) 4

---

14) Which of the following cannot be explained according to Newton's "Principle of Inertia"?

a) A little burying of a flower pot that has fallen from a height into soft soil
b) Acceleration of a falling object
c) Athlete running before a long jump
d) The propeller connected to an engine continues to rotate for a while after the engine has stopped.
e) The seat belt tightens the passenger in a car that comes to a sudden stop.

An object with mass m=2 (kg) starts moving from point A in the figure with a speed of 2 (m/s), reaches point D and stops there. The BC and DC sections of the road have some friction and the coefficients of kinetic friction are μ_1=0.2 and μ_2, respectively.
Based on this information, answer the following two questions (15-16).
(g=10 (m/s^2), cos53°=0.6 ve sin53°=0.8)



15) What is the coefficient of kinetic friction, μ_2?

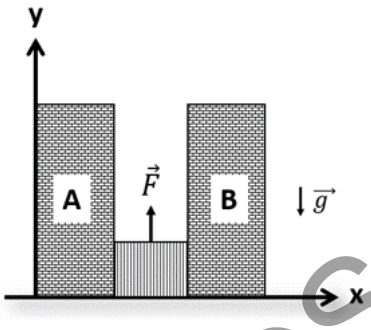
a) 0.1 b) 0.2 c) 0.3 d) 0.4 e) 0.5

16) What is the work done by the gravitational force in CD part of the road in (J) unit?

a) -16 b) -24 c) -40 d) -18 e) -12

DEPARTMENT OF PHYSICS - YTU

An object with mass $m = 4$ kg is pulled upwards from the ground with a constant force of F=52 (N) between the 2 (m) height walls A and B in the figure without breaking contact with the walls (A and B walls are made of the same material). The friction force (f) exerted by both wall surfaces to the object during the motion of the object changes as f=2+y (N), where y is the height of the object from the ground.
Based on this information, answer the following three questions (17-19). (g=10 (m/s^2))



17) What is the total work done by the forces of friction when y=2 (m)?

a) -14 b) -32 c) -24 d) -16 e) -12

18) What is the total work done when y= 2 (m)?

a) 14 b) 32 c) 24 d) 16 e) 12

19) If the object started to move from rest at y=0, what is its speed in (m/s) unit at y=2 (m)?

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

---

20) A particle is under the influence of the force $F_x = \left(\frac{4}{x^3} - \frac{1}{x^2}\right)$ (N) where x is in meters. In which option is the potential energy function of the object correctly given, where c is the integral constant?

a) $\frac{2}{x^2} - \frac{1}{x} + c$ b) $-\frac{2}{x^2} + \frac{1}{x} + c$ c) $-\frac{4}{x^2} - \frac{1}{2x} + c$

d) $-\frac{2}{x^2} - \frac{1}{2x^3} + c$ e) $-\frac{4}{x^2} + \frac{1}{2x} + c$

YTU DEPARTMENT OF PHYSICS

No	A	No	A
1.	B	**11.**	C
2.	E	**12.**	A
3.	D	**13.**	E
4.	C	**14.**	B
5.	A	**15.**	D
6	B	**16.**	C
7	E	**17.**	E
8.	A	**18.**	E
9.	D	**19.**	B
10.	C	**20.**	A

YTU
DEPARTMENT OF PHYSICS