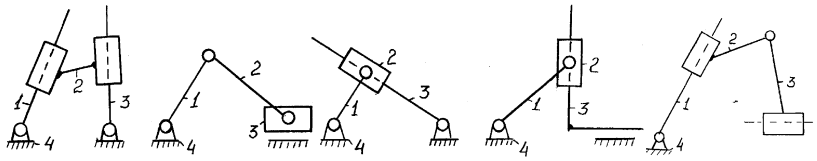
APPROVED
M. Kindrachuk.

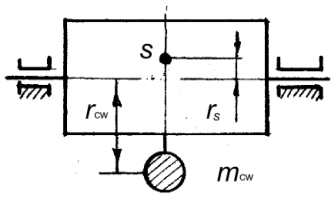
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 1

1. Which of these mechanisms is called slotted-link mechanism ?

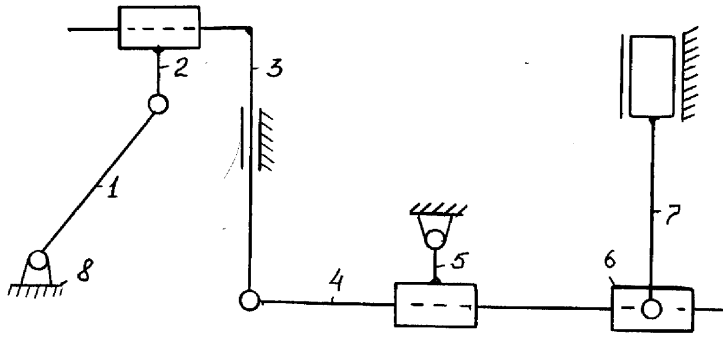


a *b* *c* *d* *e*

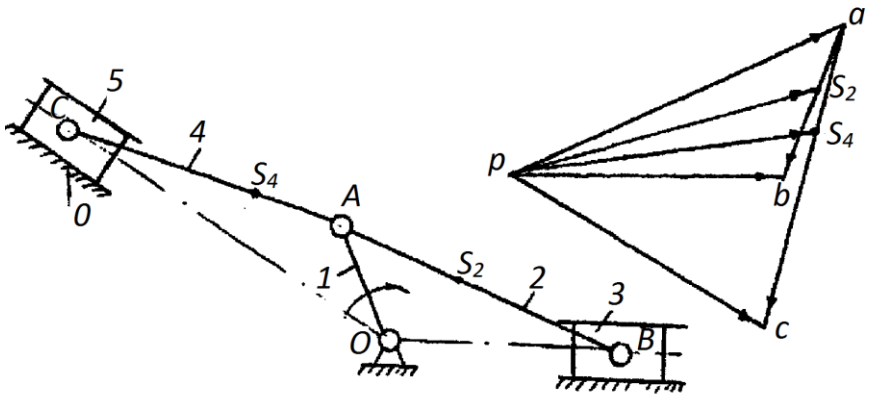
2. Link with mass m = 10 kg is statically balanced by counterweight m_{cw} = 25 g. Determine the radius of counterweight r_{cw}, if the distance r_S = 0,25 mm.



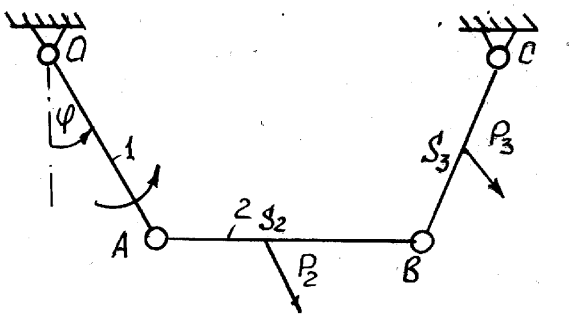
3. Determine mechanism structure



4. Determine scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A*, *B*, *C*, S_2, S_4 (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram. *Initial data:* Angular velocity of the crank 1: ω_1 = 100 s^{-1}; links dimensions: l_{OA} = 0,02 m; l_{AB} = 0,1 m; l_{AC} = 0,09 m;



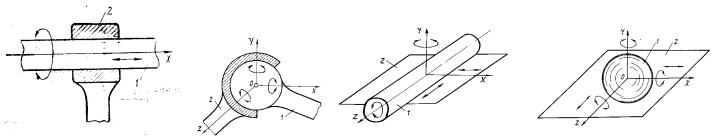
5. Determine reduced moment of the mechanism by Zhukovskyi method if: P_2 = 4 N; P_3 = 7 N; φ = 10^0. Dimensions of links: ℓ_{OA} = 35 mm; ℓ_{AB} = 40 mm; ℓ_{AS2} = 15 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, Centre of gravity of link BS (3) is in the point S_3.



APPROVED
M. Kindrachuk.

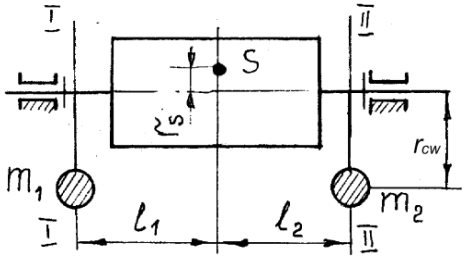
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 2

1. Which of kinematic pairs is a 4 class pair?

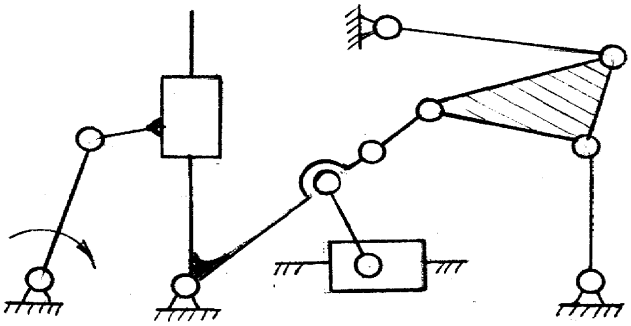


a *b* *c* *d* *e*

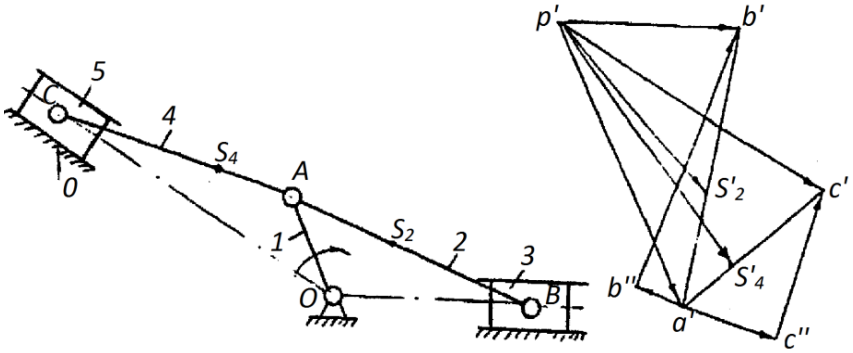
2. A rotating link is balanced by 2 counterweights m_1 i m_2, they are installed on equel distancees r_{cw} from the axis of rotation. Determine the mass of the link, if the masses of counterweights $m_1 = m_2 = 10$ g; distances $r_S = 1$ mm;
$r_{cw} = 25$ cm; $\ell_1 = \ell_2$.



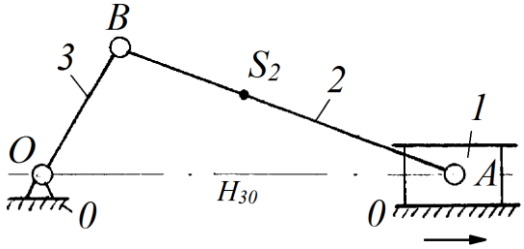
3. Determine mechanism structure



4. Determine acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S*$_2$, *S*$_4$ (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram.. *Initial data:* Angular velocity of the crank 1: $\omega_1 = 100$ s^{-1}. Links dimensions: $l_{OA} = 0{,}02$ m; $l_{AB} = 0{,}1$ m; $l_{AC} = 0{,}09$ m.



5. For given mechanism position to determine reduced mass $\mathbf{m_{red}}$: $m_1 = 4$ kg; $m_2 = 3$ kg, $J_{S2} = 0{,}15$ kgm^2, $J_{S3} = 0{,}2$ kgm^2; $\ell_{OB} = 40$ mm; $\ell_{AB} = 70$mm; ℓ_{AS2}=35mm. The slider *1* is assumed *a*s the reduced link.



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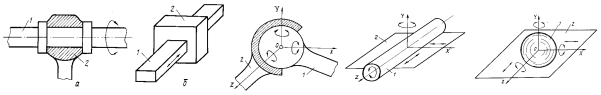
M. Kindrachuk.

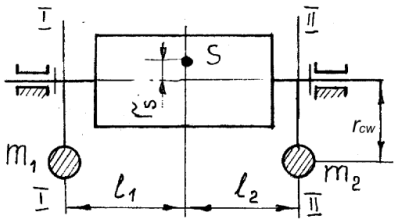
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 3

1. Which of kinematic pairs is a 1class pair ?

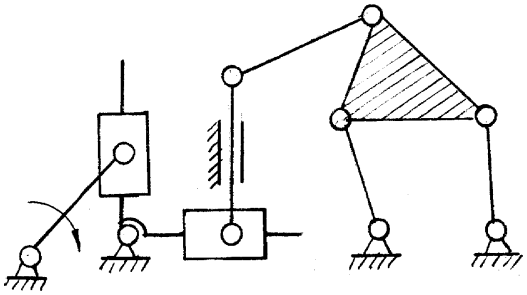


a *b* *c* *d* *e*

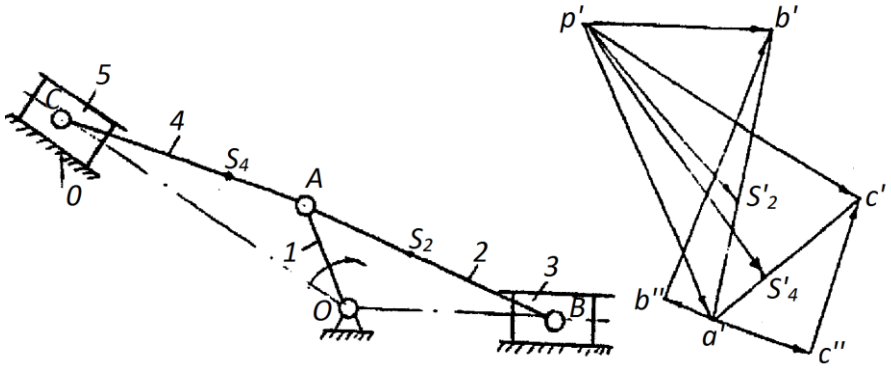
2. A rotating link is balanced by 2 counterweights m_1 i m_2, are installed on equel distancees r_{cw} from the axis of rotation. Determine the mass of the link m, distances ℓ_1 i ℓ_2, if the masses of couterweights $m_1 = m_2 =$ 20 g; distances r_S = 0,5 mm; r_{cw} = 20 sm; $\ell_1 = \ell_2$ = 50 cm.



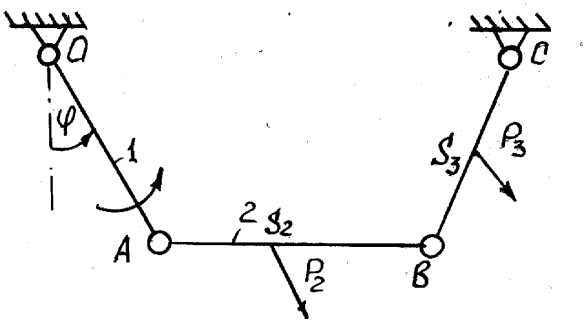
3. Determine mechanism structure



4. Determine inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram. *Initial data*. Links dimensions: l_{AC} =0,1 m; l_{AC} = 0,09 m. The masses of the links: m_2 = 0, 6 kg; m_3 = 0,5 kg; m_4 =0,55 kg; m_5 = 0,48 kg. Links products of inertia: J_{S2} = 0,0085 kg m^2; J_{S4} = 0, 0078 kg m^2, μ_a = 10 m·sec^{-2}/mm.



5. Determine reduced moment of the mechanism by Zhukovskyi method if: P_2 = 4 N; P_3 = 7 N; φ = 60^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 40 mm; ℓ_{AS2} = 15 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, Centre of gravity of link BS (3) is in the point S_3.



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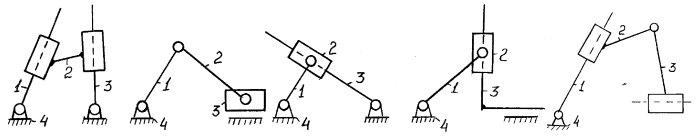
M. Kindrachuk.

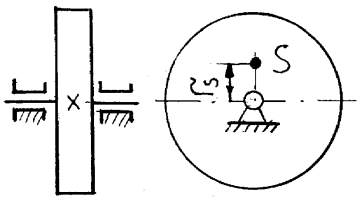
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 4

1. Which of these mechanisms is called crank-slider mechanism?

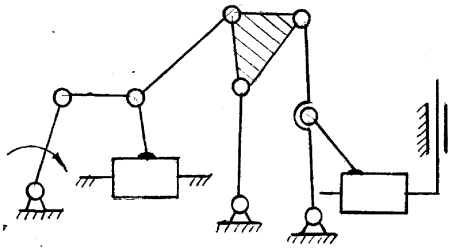


a *b* *c* *d* *e*

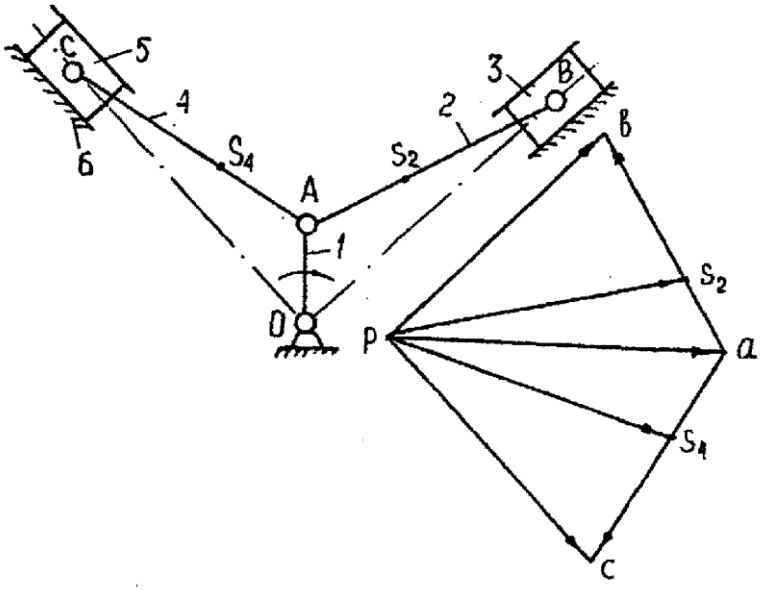
2. Centre of gravity of link, що rotates with constant frequency n = 20000 rpm, r_S = 0,1 mm. Determine the mass of the link, if on it a force P_i = 660 N acts.



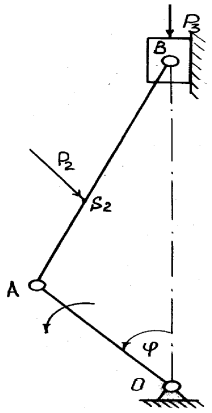
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A, B, C, S*$_2$, *S*$_4$ (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram.. *Initial data:* Angular velocity of the crank 1: ω_1 = 80 s^{-1}. Links dimensions: l_{OA} = 0,05 m; l_{AB} = l_{AC} = 0,2 m.



5 Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 5 N; P_3 = 8 N; $\varphi = 45^0$. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60 mm; ℓ_{AS2} = 25 mm. Centre of gravity of link AB (2) is in the point S_2.



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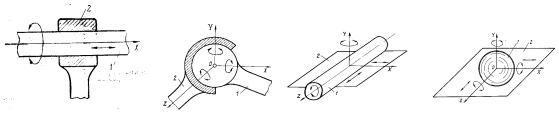
M. Kindrachuk.

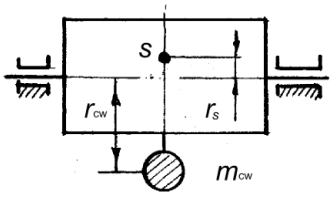
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 5

1. Which of kinematic pairs is a 4 kind kinematic pair?

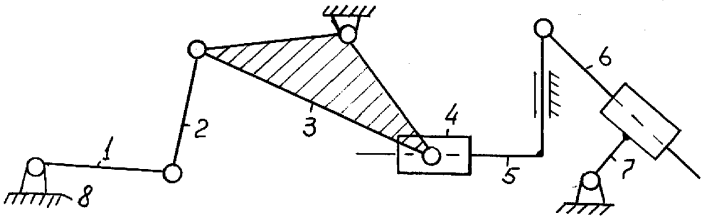


a *b* *c* *d*

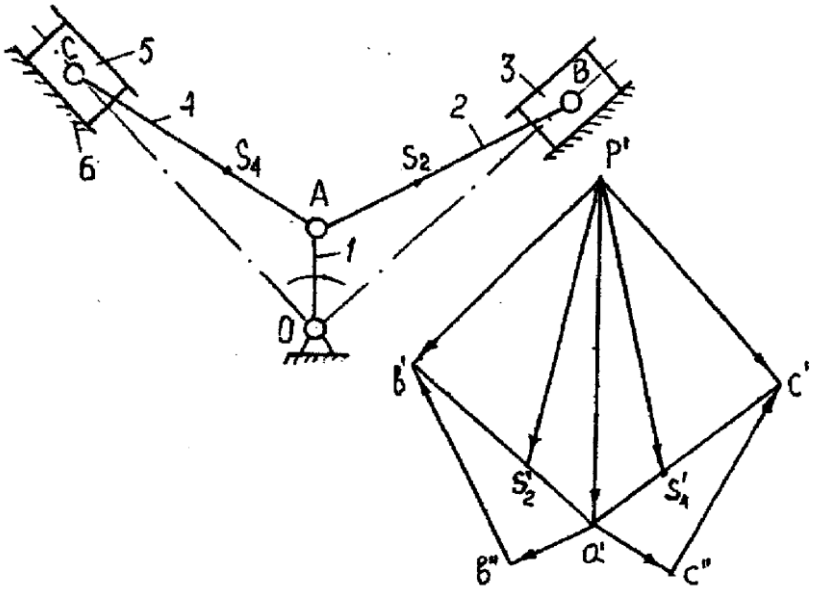
2. Determine the mas of counterweight m_{cw}, if it is installed on a distance r_{cw} = 10 sm from the axes of rotation, r_S = 0,5 mm; m = 2 kg.



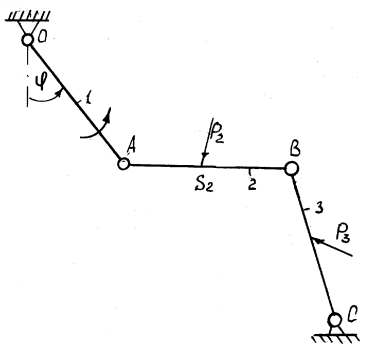
3. Determine mechanism structure



4. Determine acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S*$_2$, *S*$_4$ (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram. *Initial data:* Angular velocity of the crank 1: $\omega_1 = 80\ s^{-1}$.
Links dimensions: l_{OA} = 0,05 m; $l_{AB} = l_{AC}$ = 0,2 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 4 N; P_3 = 7 N; φ = 60^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 45mm; ℓ_{AS2} = 20mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3



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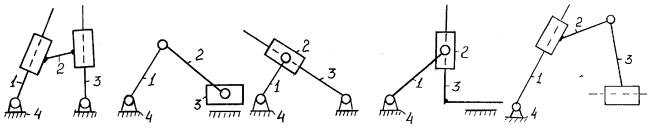
M. Kindrachuk.

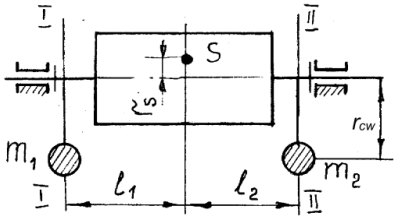
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 6

1. Which of these mechanisms is called double-slotted mechanism ?

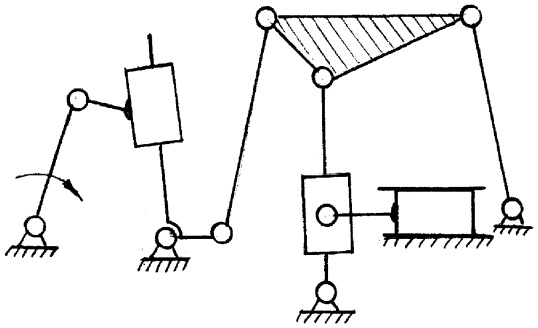


a *b* *c* *d* *e*

2. A rotating link is balanced by 2 counterweights m_1 i m_2, are installed on equel distancees r_{cw} from the axis of rotation. Determine the mass of the link, if the masses of counterweights $m_1 = m_2 = 20$ g; distances $r_S = 1$ mm; $r_{cw} = 25$ sm; $\ell_1 = \ell_2$.

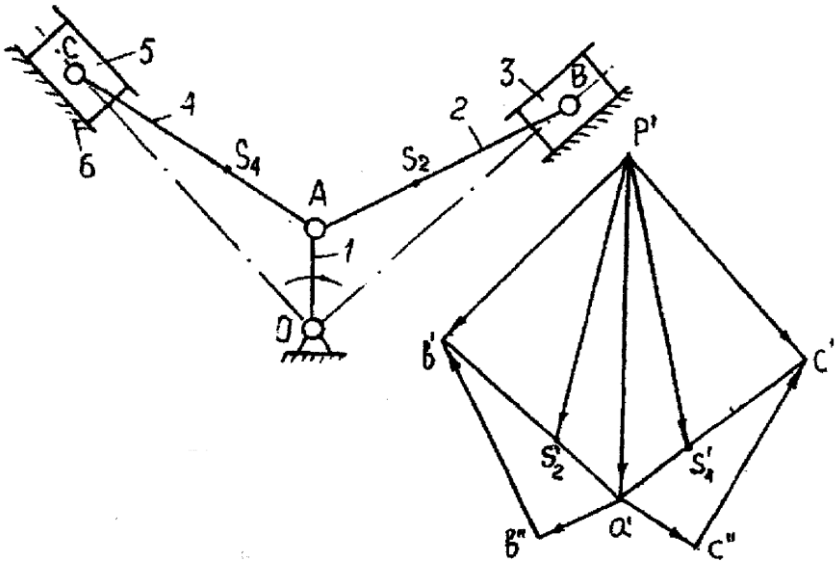


3. Determine mechanism structure

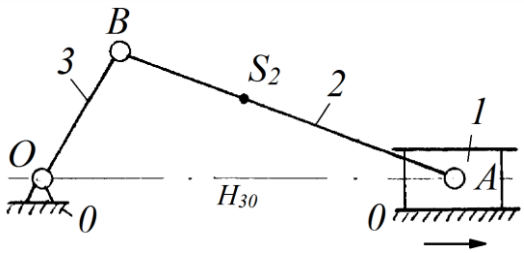


4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram.

Initial data: Links dimensions: $l_{AB} = l_{AC} = 0{,}2$ m.The masses of the links: $m_2 = m_4 = 5$ kg; $m_3 = m_5 = 4$ kg. Links products of inertia: $J_{S2} = J_{S4} = 0{,}035$ kg m^2, $K_a = 10$ m·s^{-2}/mm.



5. For given mechanism position to determine reduced mass $\mathbf{m_{red}}$: $m_1 = 4$ kg; $m_2 = 3$ kg, $J_{S2} = 0{,}15$ kgm^2, $J_{S3} = 0{,}2$ kgm^2; $\ell_{OB} = 40$ mm; $\ell_{AB} = 70$mm; ℓ_{AS2}=35mm. The slider *1* is assumed *a*s the reduced link.



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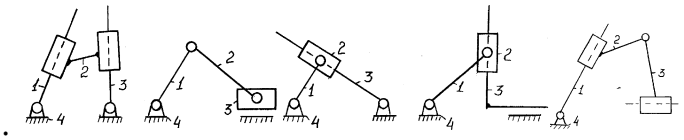
M. Kindrachuk.

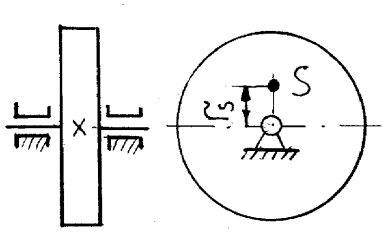
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 7

1. Which of these mechanisms is called double-slider mechanism?

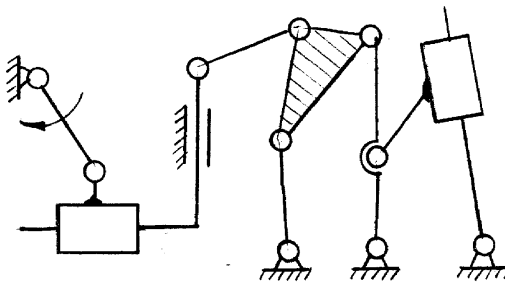


a *b* *c* *d* *e*

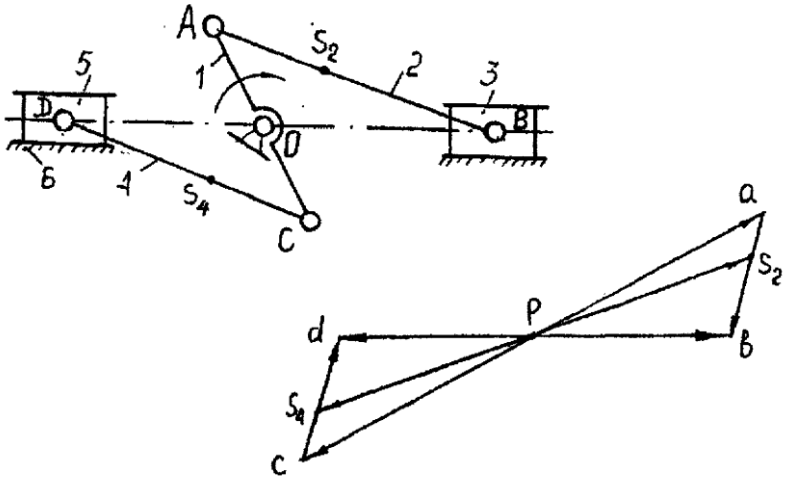
2. Link with mass m = 1,5 kg rotates with constant frequency n = 30000 rpm. Determine the distance r_S from centre of mass to the axis of rotation, if on the link an inertia force P_i = 1000 N acts.



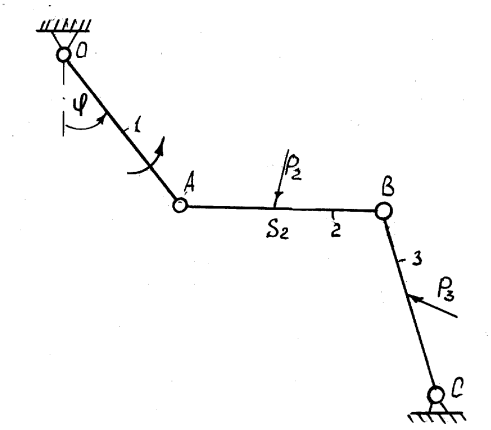
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A, B, C, S_2, S_4* (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram..
Initial data: Angular velocity of the crank *1*: ω_1 = 80 s^{-1}. Links dimensions: l_{OA}= l_{OS} =0,06 m; l_{AB} = l_{CD} = 0,22



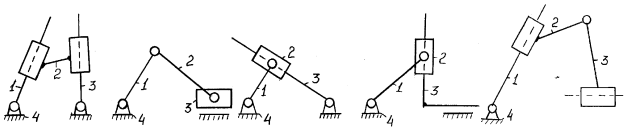
5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 4 N; P_3 = 7 N; φ = 60^0. Dimensions of links: ℓ_{OA} = 35 mm; ℓ_{AB} = 60 mm; ℓ_{AS2} = 30mm; ℓ_{BS} = 60 mm; ℓ_{BS3} = 25 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3



APPROVED
M. Kindrachuk.

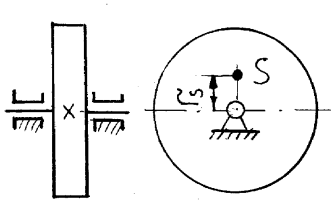
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 8

1. Which of these mechanisms is called slotted-slider mechanism?

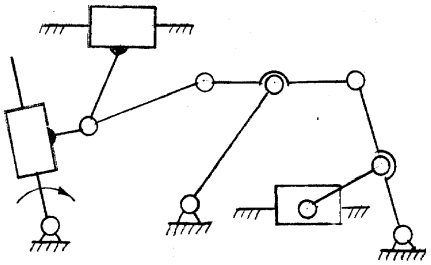


a *b* *c* *d* *e*

2. Link with mass m = 1 kg rotates with constant frequency n = 20000 rpm. Determine the distance r_S from centre of mass to the axis of rotation, if on the link an inertia force P_i = 500 N acts.

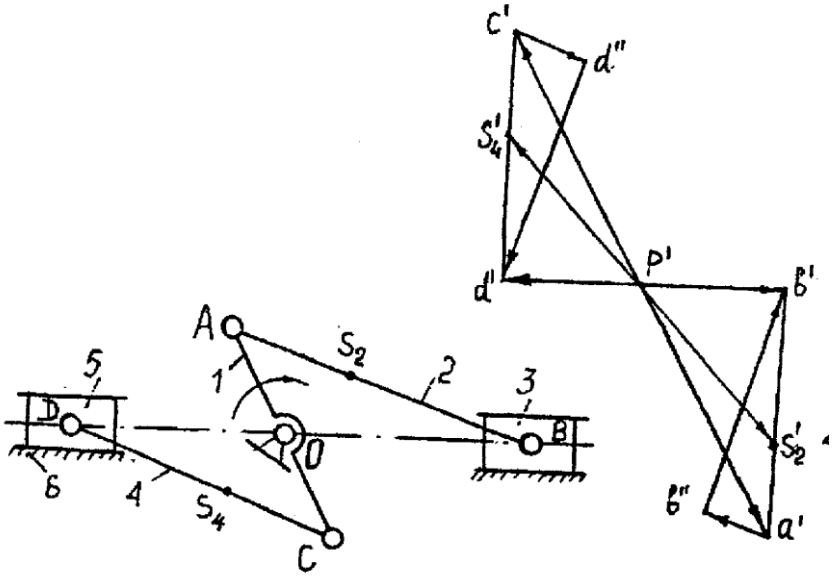


3. Determine mechanism structure

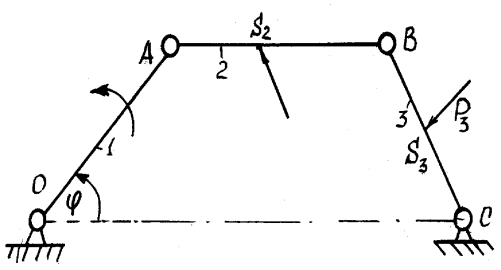


4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C*, S_2, S_4 (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram.

Initial data. Angular velocity of the crank *1*: ω_1 = 80 s^{-1}. Links dimensions: $l_{OA} = l_{OC}$ =0, 06 m; $l_{AB} = l_{CD}$ = 0,22 m.



5. Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 10 N; P_3 = 6 N; $\varphi = 50^0$. Dimensions of links: ℓ_{OA} = 35 mm; ℓ_{AB} = 45 mm; ℓ_{AS2} = 25 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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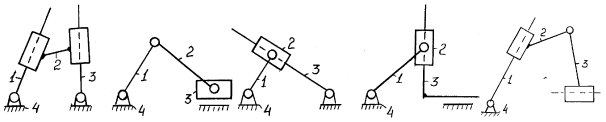
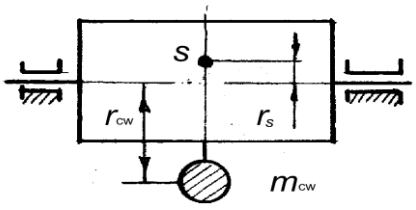
M. Kindrachuk.

Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 9

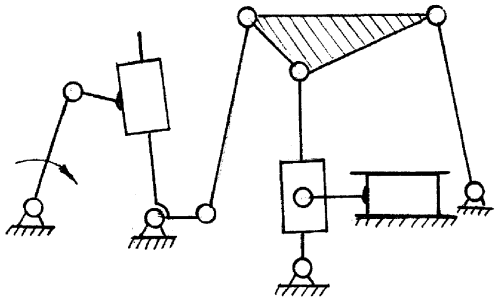
2. Which of these mechanisms is called a slotted-slider mechanism?



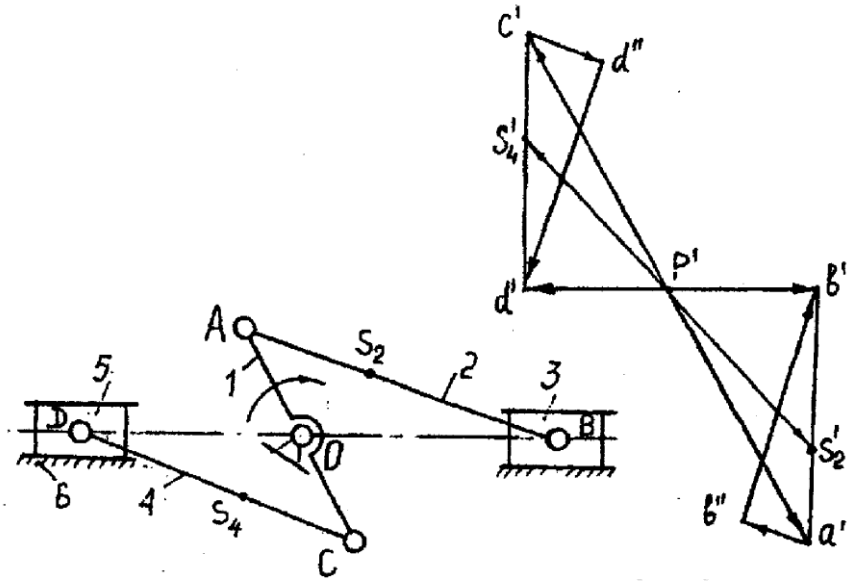
2. Link with mass m = 10 kg is statically balanced by counterweight m_{cw} = 25 g. Determine the radius of counterweight r_{cw}, if the distance r_S = 0,5 mm.



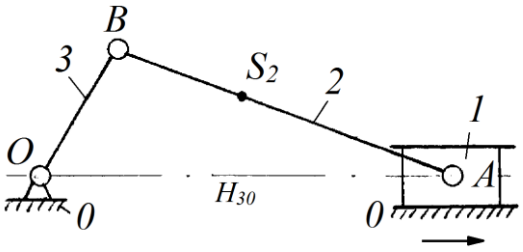
3. Determine mechanism structure



4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram.
Initial data: Links dimensions: $l_{AB} = l_{CD}$ = 0,22 m. The masses of the links: $m_2 = m_4$ = 1,1 kg; $m_3 = m_5$ = 0,9 kg. Links products of inertia: $J_{S2} = J_{S4}$ = 0,04 kg m^2, K_a = 10 m·s^{-2}/mm.



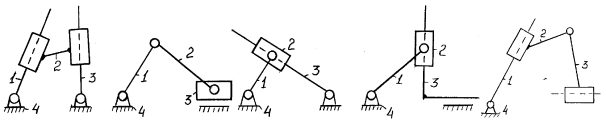
5. For given mechanism position to determine reduced mass $\mathbf{m_{red}}$: m_1 = 4 kg; m_2 = 3 kg, J_{S2} = 0,15 kgm^2, J_{S3} = 0,2 kgm^2; ℓ_{OB} = 40 mm; ℓ_{AB} = 70mm; ℓ_{AS2}=35mm. The slider *1* is assumed *a*s the reduced link.



APPROVED
M. Kindrachuk.

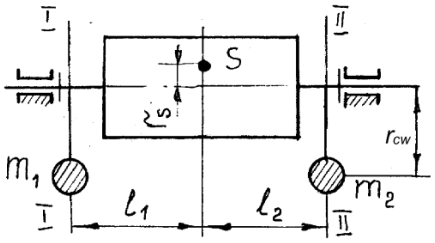
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 10

1. Which of these mechanisms is called a double-slider mechanism?

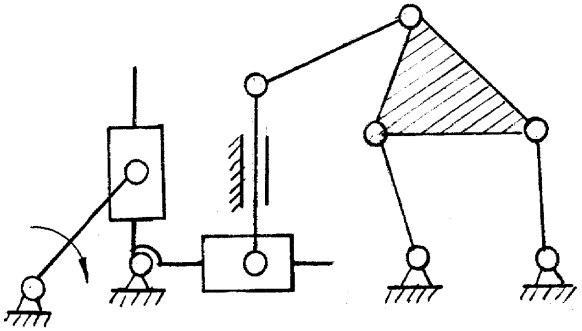


a *b* *c* *d* *e*

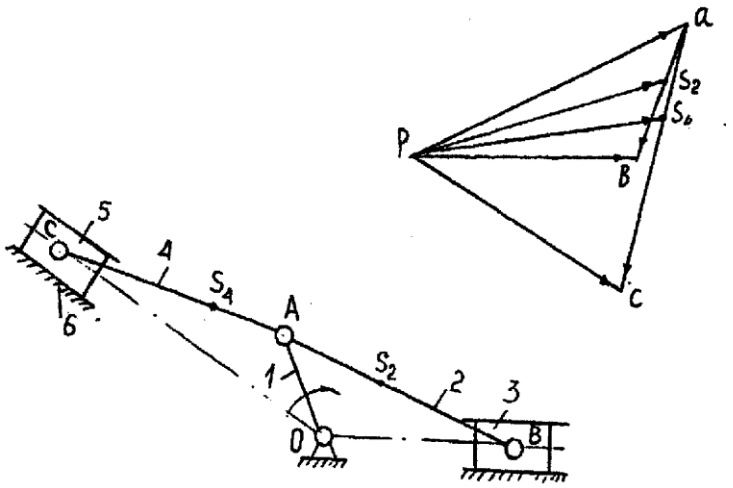
2. A rotating link is balanced by 2 counterweights $m_1 = m_2$, are installed on equel distancees r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mas of the link m = 35 kg, distances - r_S = 2 mm; $\ell_1 = \ell_2$ = 25 cm; r_{cw} = 10 cm.



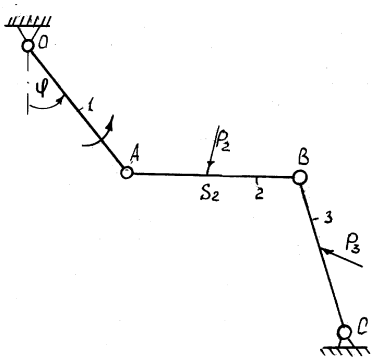
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\underline{pa}$. Determine linear velocities of points *A, B, C, S_2, S_4* (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank *1*: ω_1 = 100 s^{-1}. Links dimensions: l_{OA} = 0,075 m; l_{AB} = 0,27 m; l_{AC} = 0,25 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 4 N; P_3 = 7 N; φ = 45^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 45mm; ℓ_{AS2} = 20mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3



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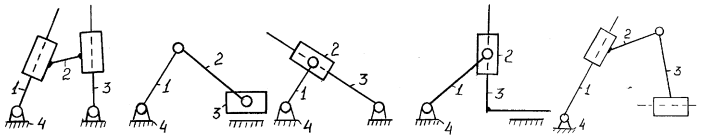
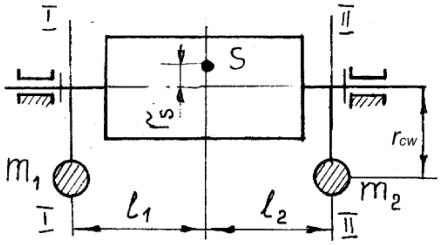
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 11

2. Which of these mechanisms is called a slotted-slider?

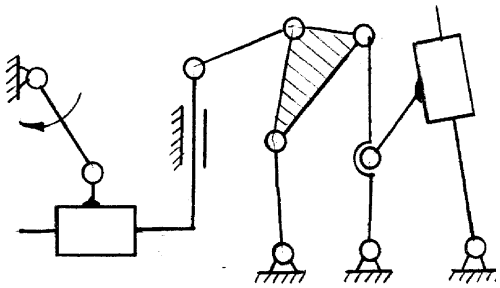


a *b* *c* *d* *e*

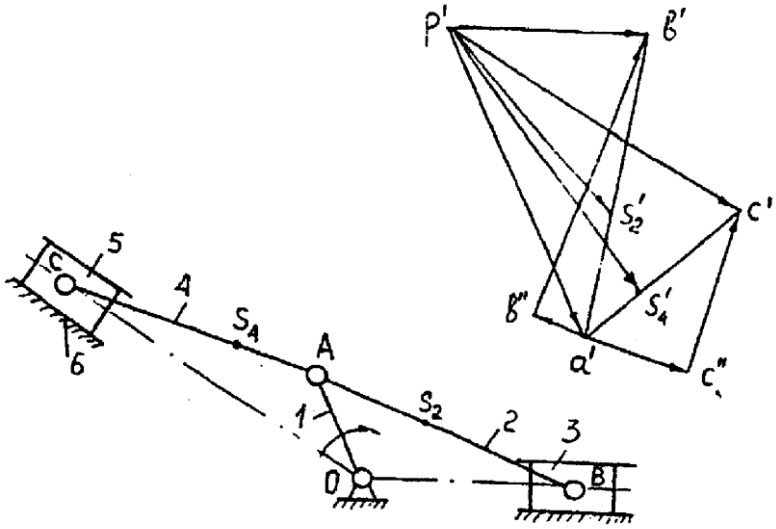
2. A rotating link is balanced by 2 counterweights $m_1 = m_2$, are installed on equel distancees r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mas of the link m = 40 kg, distances - r_S = 3 mm; ℓ_1 = 10 cm; ℓ_2 = 10 cm; r_{cw} = 20 cm.



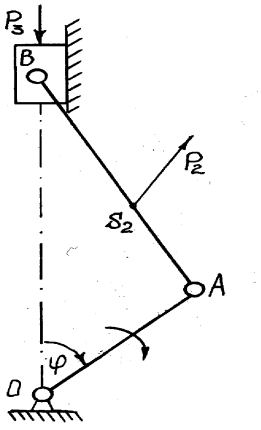
3. Determine mechanism structure



4. Determine acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S_2, S_4* (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram. *Initial data:* Angular velocity of the crank *1*: ω_1 = 100 s^{-1}. Links dimensions: l_{OA} = 0, 075 m; l_{AB} = 0, 27 m; l_{AC} = 0, 25 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 3 N; P_3 = 12 N; $\varphi = 60^0$. Dimensions of links: ℓ_{OA} = 30 mm;
ℓ_{AB} = 60 mm; ℓ_{AS2} = 20 mm. Centre of gravity of link AB (2) is in the point S_2



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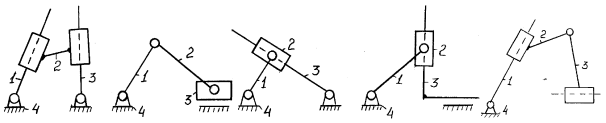
M. Kindrachuk.

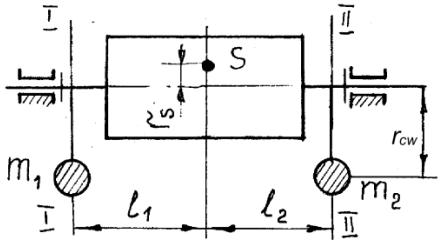
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 12

2. Which of these mechanisms is called crank-slider mechanism?

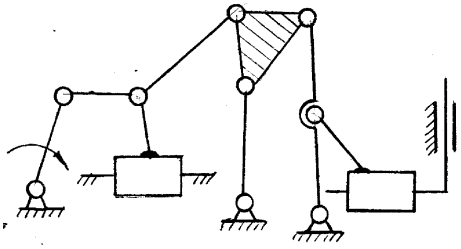


a *b* *c* *d* *e*

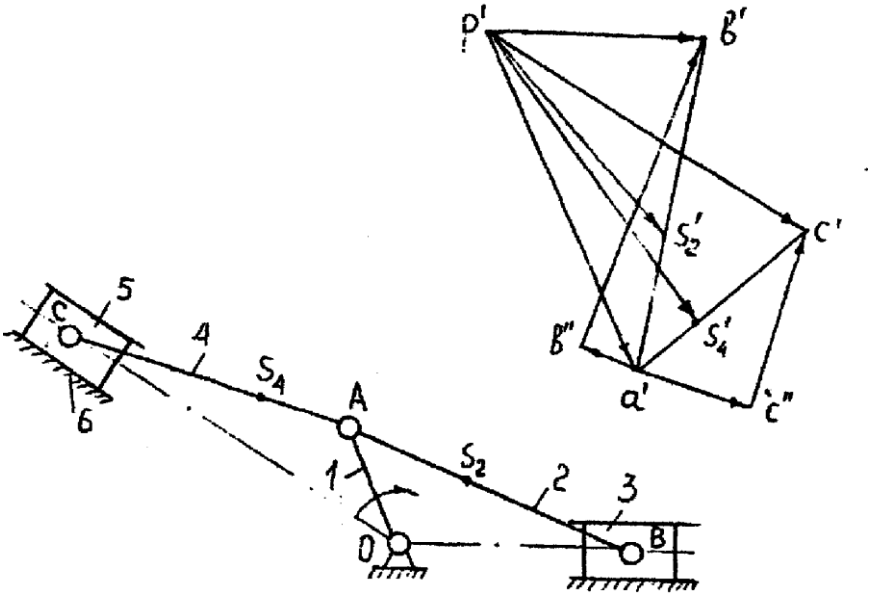
2. A rotating link is balanced by 2 counterweights $m_1 = m_2$, are installed on equal distances r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mass of the link m = 30 kg, distances - r_S = 2 mm;
$\ell_1 = \ell_2$ = 20 cm; r_{cw} = 20 cm.



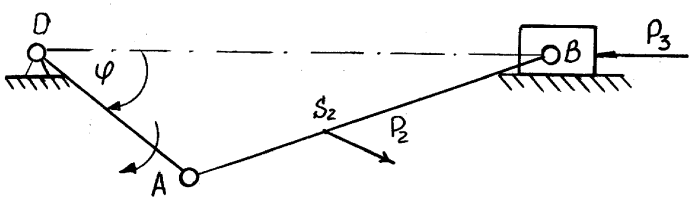
3. Determine mechanism structure



4. Determine inertia forces and moments of inertia forces acting to pistons *3* and *5,* con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram.
Initial data: Links dimensions: l_{AB} = 0,27 m; l_{AC} = 0,25 m. The masses of the links: m_2 = 6 kg; m_3 = 5 kg; m_4 = 5, 5 kg; m_5 = 4, 8 kg. Links products of inertia: J_{S2} = 0,085 kg m^2; J_{S4} = 0,078 kg m^2.
μ_a = 10 m·s^{-2}/mm.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 2N; P_3 = 5N; φ = 120^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60mm; ℓ_{AS2} = 25mm. Centre of gravity of link AB (2) is in the point S_2.



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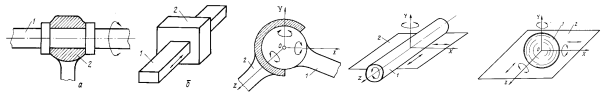
M. Kindrachuk.

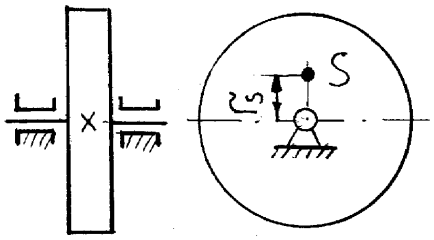
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 13

1. Which of kinematic pairs is a pair of the 2 class?

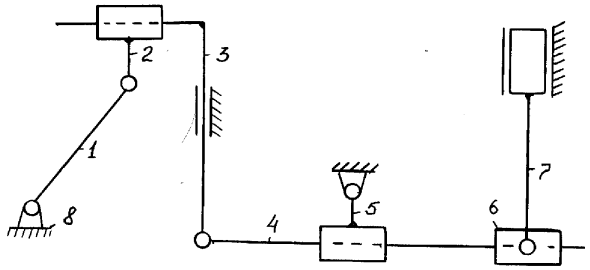


a *b* *c* *d* *e*

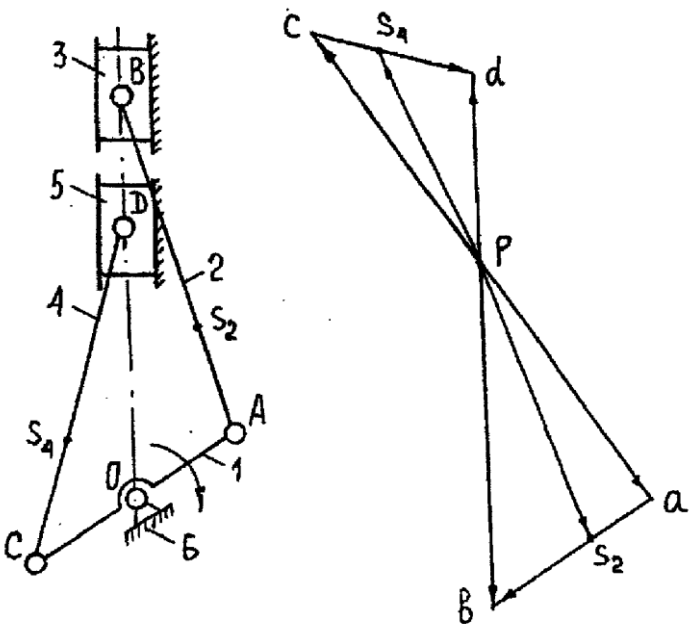
2. Link with mass m = 1 kg rotates with constant frequency n = 30000 rpm. Determine the inertia force which acts to the link if its Centre of gravity of link is displaced on a distance of r_S = 0,1 mm from axis of rotation.



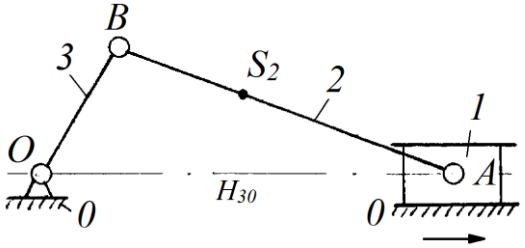
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A*, *B*, *C*, S_2, S_4 (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram..
Initial data: Angular velocity of the crank *1*: ω_1 = 60 s^{-1}. Links dimensions: $l_{OA} = l_{OC}$ =0,08 m; $l_{AB} = l_{CD}$ = 0,3 m.



5. For given mechanism position to determine reduced mass $\mathbf{m_{red}}$: m_1 = 4 kg; m_2 = 3 kg, J_{S2} = 0,15 kgm^2, J_{S3} = 0,2 kgm^2; ℓ_{OB} = 40 mm; ℓ_{AB} = 70mm; ℓ_{AS2}=35mm. The slider *1* is assumed *a*s the reduced link.



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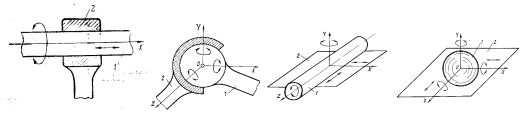
M. Kindrachuk.

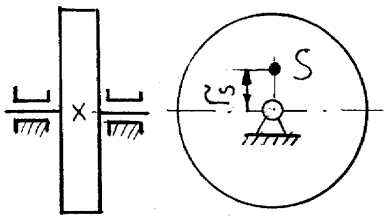
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 14

1. Which of kinematic pairs is a 4 class kinematic pair?

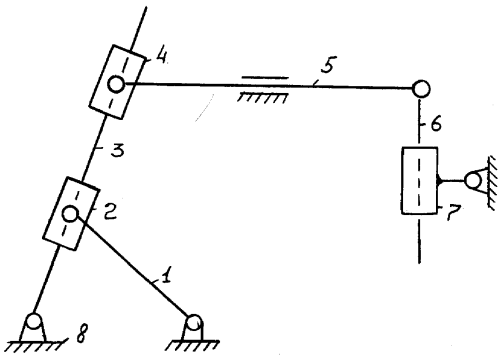


a *b* *c* *d* *e*

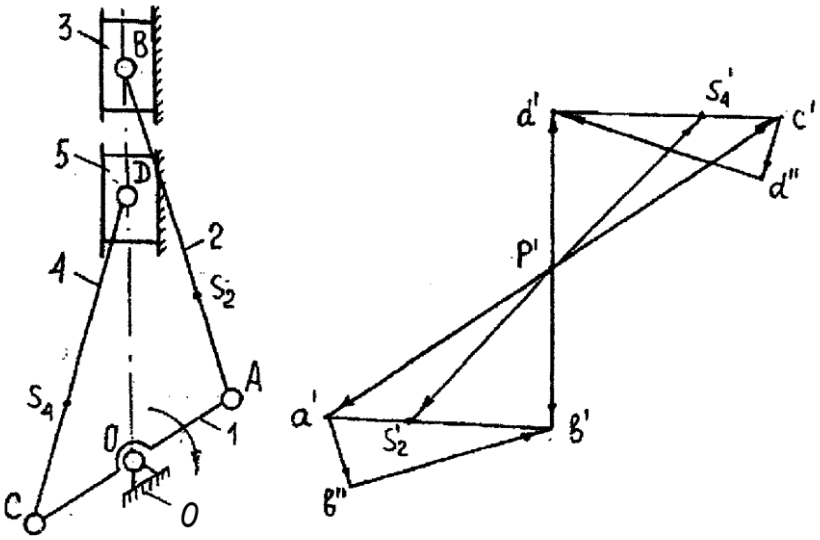
2. Link with mass m = 1 kg rotates with constant frequency n = 15000 rpm. Determine the inertia force which acts to the link if its Centre of gravity of link is displaced on a distance of r_S = 0,2 mm from axis of rotation.



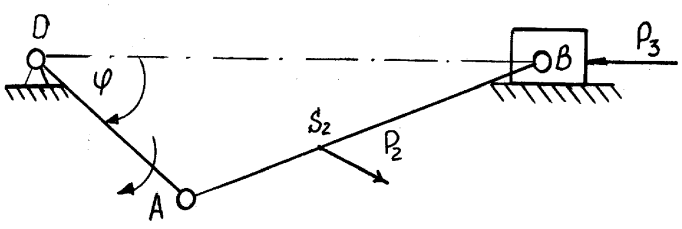
3. Determine mechanism structure



4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S*$_2$, *S*$_4$ (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram. *Initial data:* Angular velocity of the crank *1*: ω_1 = 60 s^{-1}. Links dimensions: $l_{OA} = l_{OC}$ = 0,08 m; $l_{AB} = l_{CD}$ = 0,3 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if: P_2 = 2 N; P_3 = 5 N; $\varphi = 30^0$. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60mm; ℓ_{AS2} = 25mm. Centre of gravity of link AB (2) is in the point S_2.



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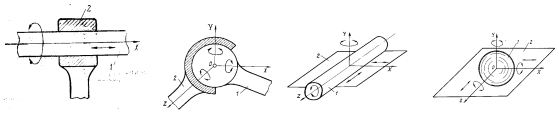
M. Kindrachuk.

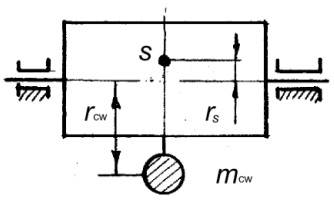
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 15

1. Which of kinematic pairs is a 3 kind kinematic pair?

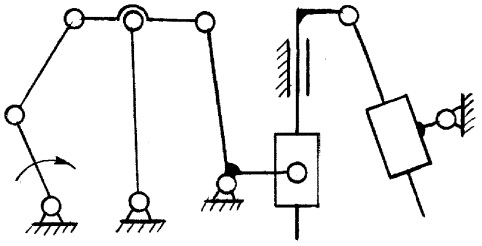


a *b* *c* *d*

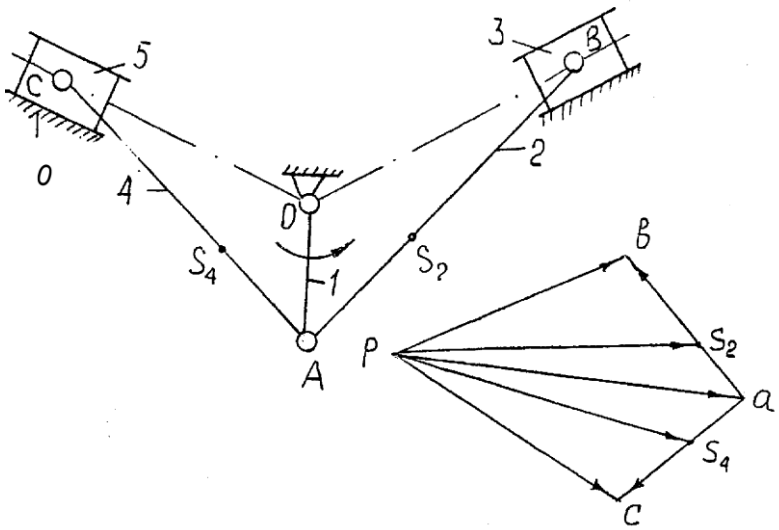
2. Link with mass m = 12 kg is statically balanced with a counterweight m_{cw} = 20 g. Determine the radius r_{cw}, if distance r_S = 0,7 mm.



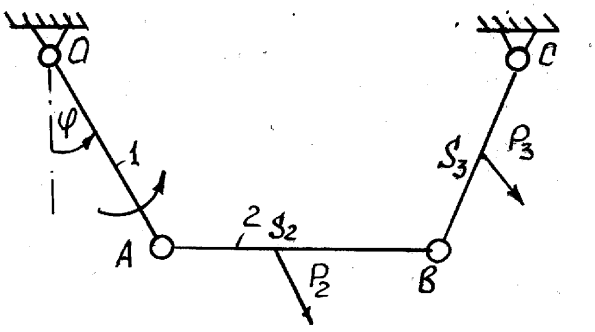
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A*, *B*, *C*, S_2, S_4 (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram..
Initial data: Angular velocity of the crank *1*: ω_1 = 120 s^{-1}. Links dimensions: l_{OA} = 0,05 m; l_{AB} = l_{AC} = 0,2 m.



5 Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 2 N; P_3 = 5 N; φ = 20^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60 mm; ℓ_{AS2} = 25 mm; ℓ_{BS} = 60 mm; ℓ_{BS3} = 30 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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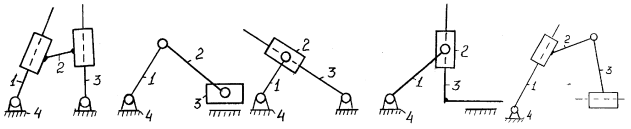
M. Kindrachuk.

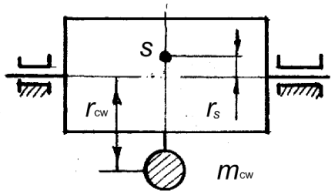
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 16

2. Which of these mechanisms is called double-slider mechanism?

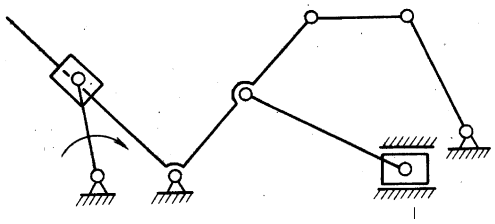


a *b* *c* *d* *e*

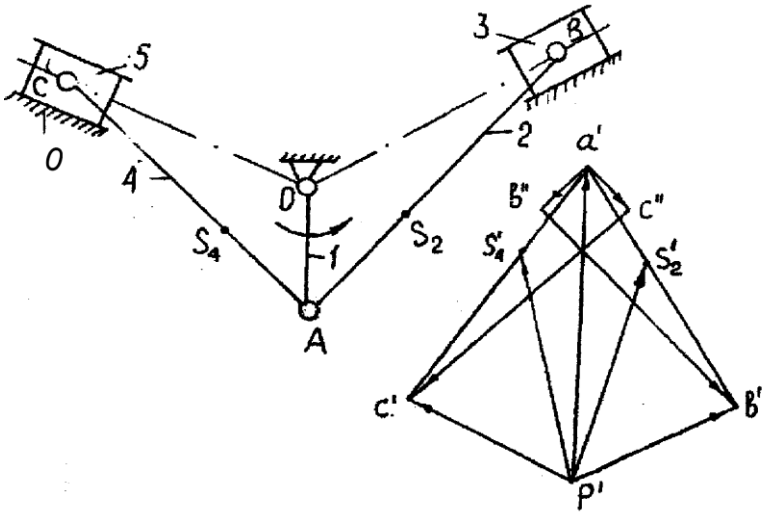
2. Link with mass m = 15 kg is statically balanced with a counterweight m_{cw} = 35 g. Determine the radius r_{cw}, if distance r_S = 1 mm.



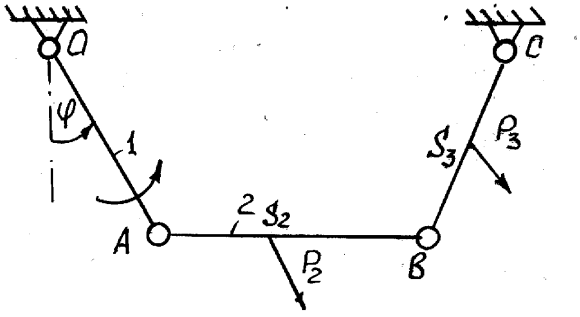
3. Determine mechanism structure



4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C,* S_2, S_4 (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank 1: ω_1 = 120 s^{-1}. Links dimensions: l_{OA} = 0,05 m; l_{AB} = l_{AC} = 0,2 m.



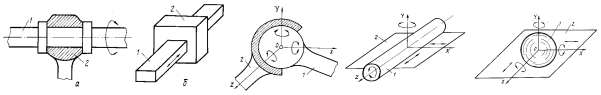
5 Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 7 N; P_3 = 10 N; $\varphi = 30^0$. Dimensions of links:
ℓ_{OA} = 30 mm; ℓ_{AB} = 45 mm; ℓ_{AS2} = 25 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



APPROVED
M. Kindrachuk.

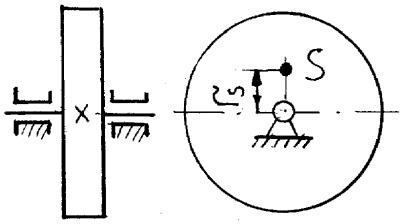
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 17

1. Which of kinematic pairs is a 5 class kinematic pair?

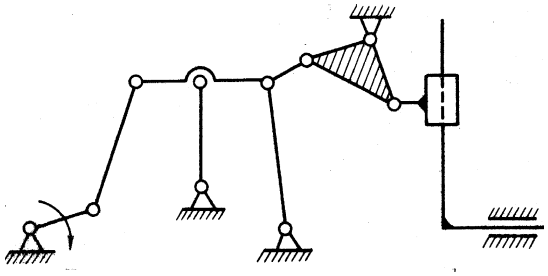


a *b* *c* *d* *e*

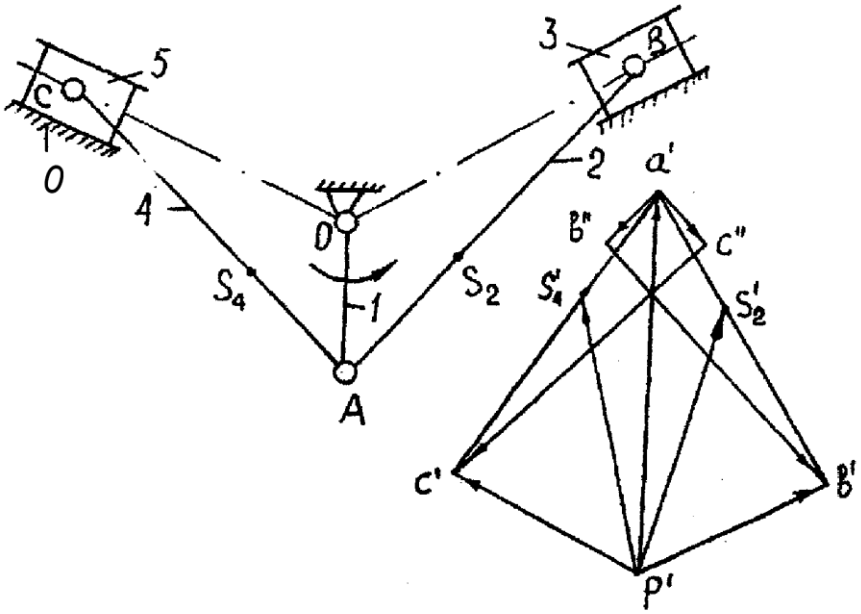
2. Link with mass m = 1 kg rotates with constant frequency n = 40000 rpm. Determine the distance r_S from the Centre of mass if on the link an inertia force P_i = 500 N acts.



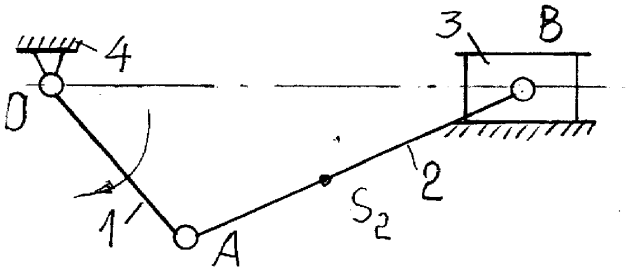
3. Determine mechanism structure



4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram.
Initial data. Links dimensions: l_{AB} = l_{AC} = 0,09 m. The masses of the links: m_2 = m_4 = 1,5 kg; m_3 = m_5 = 1,2 kg. Links products of inertia: J_{S2} = J_{S4} = 0,008 kg m^2. μ_a = 10 m·s^{-2}/mm.



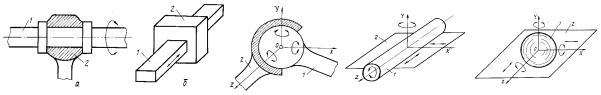
5. For a given mechanism position determine reduced moment of inertia if:
m_2 = 5 kg; m_3 = 9 kg; J_{S1} = 0,2 kgм^2, J_{S2} = 0,5 kgм^2; ℓ_{OA} = 35 mm; ℓ_{AB} = 70mm. ℓ_{AS} = 30 mm.



APPROVED
M. Kindrachuk.

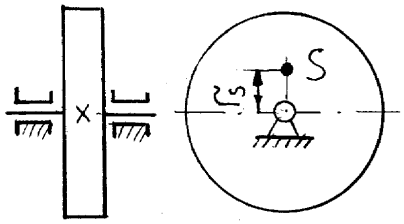
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 18

1. Which of kinematic pairs is a 1 class kinematic pair?

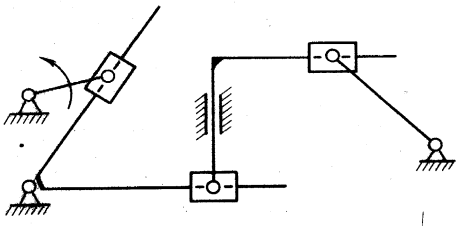


a *b* *c* *d* *e*

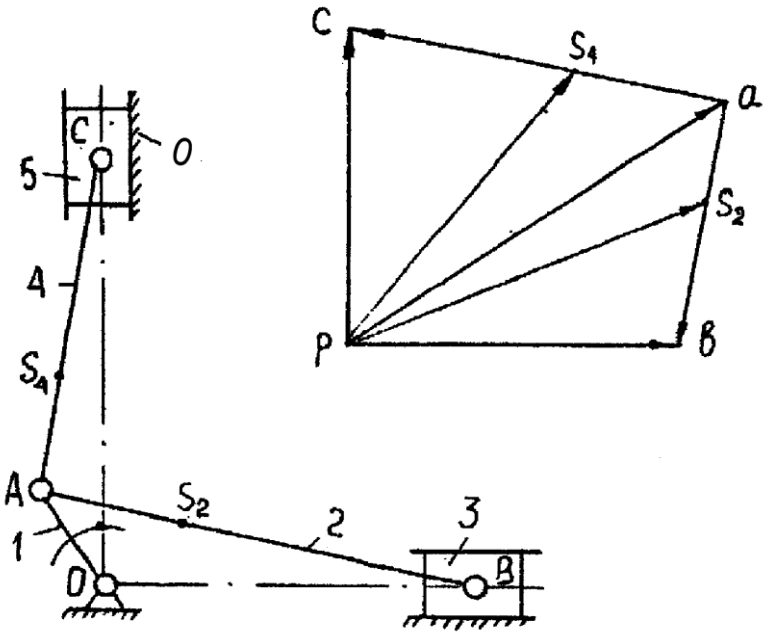
2. Link with mass m = 2 kg rotates with constant frequency n = 40000 rpm. Determine the distance r_S from the Centre of mass if on the link an inertia force P_i = 500 N acts.



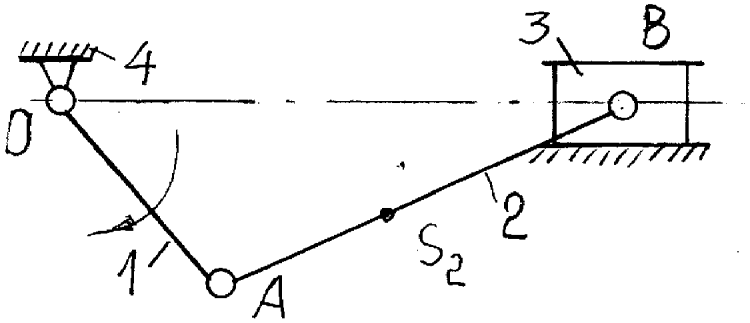
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A, B, C, S*$_2$, *S*$_4$ (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram
Initial data. Angular velocity of the crank 1: ω_1 = 100 s^{-1}. Links dimensions: l_{OA} = 0,06 m; l_{AB} = 0,25 m; l_{AC} = 0,2 m.



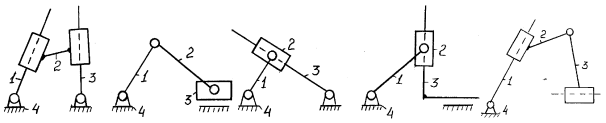
5. For a given mechanism position determine reduced moment of inertia if:
m_2 = 5 kg; m_3 = 9 kg; J_{S1} = 0,2 kgм^2, J_{S2} = 0,5 kgм^2 ;
ℓ_{OA} = 35 mm; ℓ_{AB} = 70mm. ℓ_{AS} = 30 mm.



APPROVED
M. Kindrachuk.

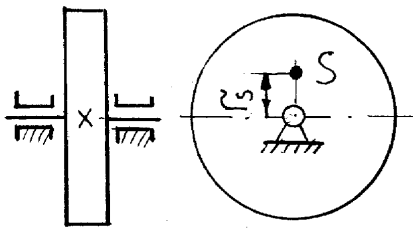
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 19

1. Which of these mechanisms is called a double-slider mechanism?

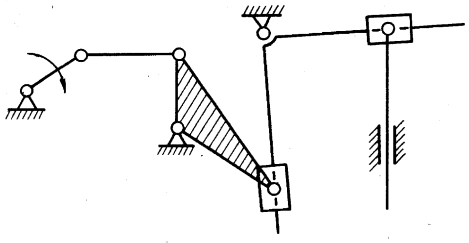


a *b* *c* *d* *e*

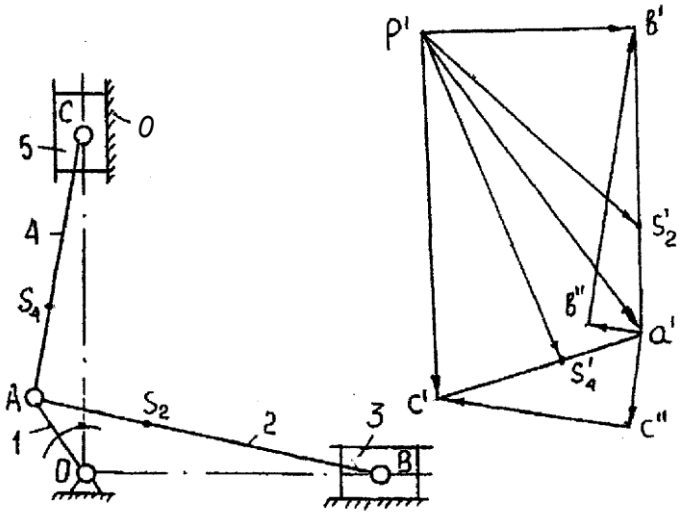
2. Link with mass m = 1 kg rotates with constant frequency n = 20000 rpm. Determine the distance r_S from the Centre of mass if on the link an inertia force P_i = 500 N acts.



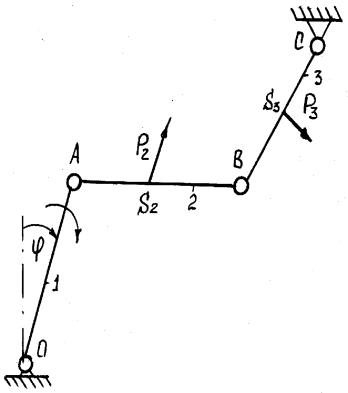
3. Determine mechanism structure



4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C*, S_2, S_4 (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank 1: ω_1 = 100 s^{-1}. Links dimensions: l_{OA} = 0,06 m; l_{AB} = 0,25 m; l_{AC} = 0,2 m.



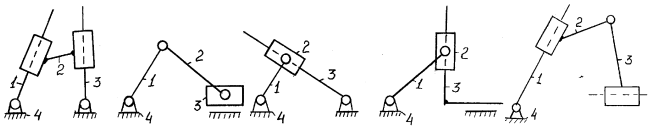
5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 6 N; P_3 = 10 N; $\varphi = 30^0$. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 50mm; ℓ_{AS2} = 25mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, Centre of gravity of link BS (3) is in the point S_3.



APPROVED
M. Kindrachuk.

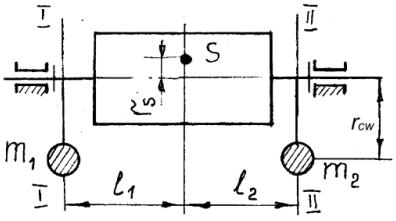
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 20

1. Which of these mechanisms is called a slotted-slider mechanism?

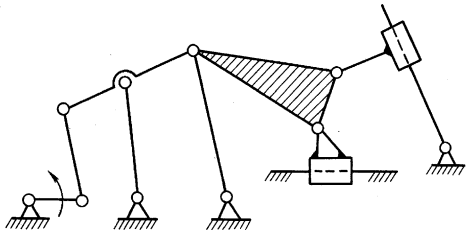


a *b* *c* *d* *e*

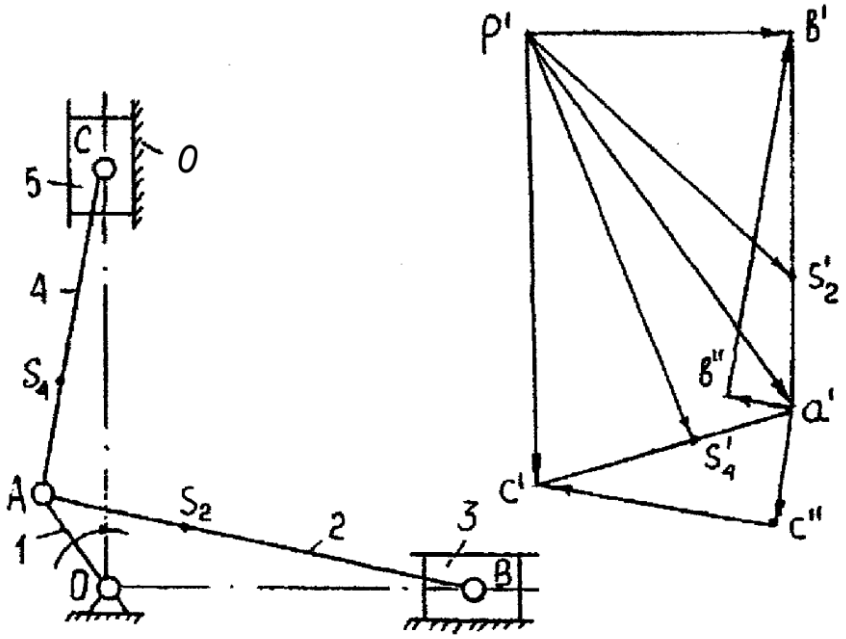
2. A rotating link is balanced by 2 counterweights m_1=m_2 = 30 g., are installed on equal distances r_{cw} from the axis of rotation. Determine the distance r_S , if the mass of the link m = 5 kg, distances - ℓ_1 = ℓ_2 = 20 cm; r_{cw} = 20 cm.



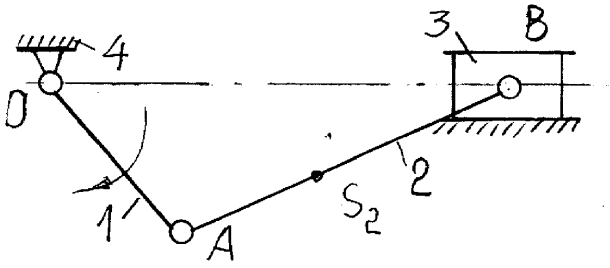
3. Determine mechanism structure



1. 4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram.
Initial data. Links dimensions: l_{AB} = 0,25 m; l_{AC} = 0,2 m. The masses of the links: m_2 = 1,4 kg; m_3 = 1,1 kg; m_4 = 1,2 kg; m_5 = 0,9 kg. Links products of inertia: J_{S2} = 0,0085 kg m^2; J_{S4} = 0,008 kg m^2 μ_a=10 m·s^{-2}/mm.



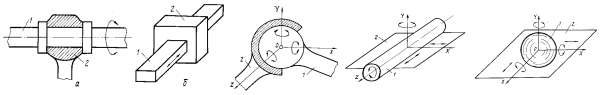
5. For a given mechanism position determine reduced moment of inertia if:
m_2 = 4.5 kg; m_3 = 9.5 kg; J_{S1} = 0,2 kgм^2, J_{S2} = 0,5 kgм^2; ℓ_{OA} = 35 mm; ℓ_{AB} = 70mm. ℓ_{AS} = 30 mm.



APPROVED
M. Kindrachuk.

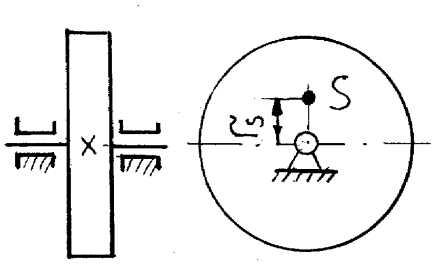
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 21

1. Which of kinematic pairs is a 3 class kinematic pair?

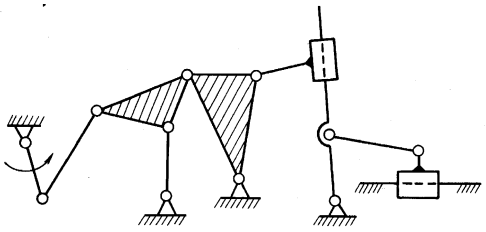


a *b* *c* *d* *e*

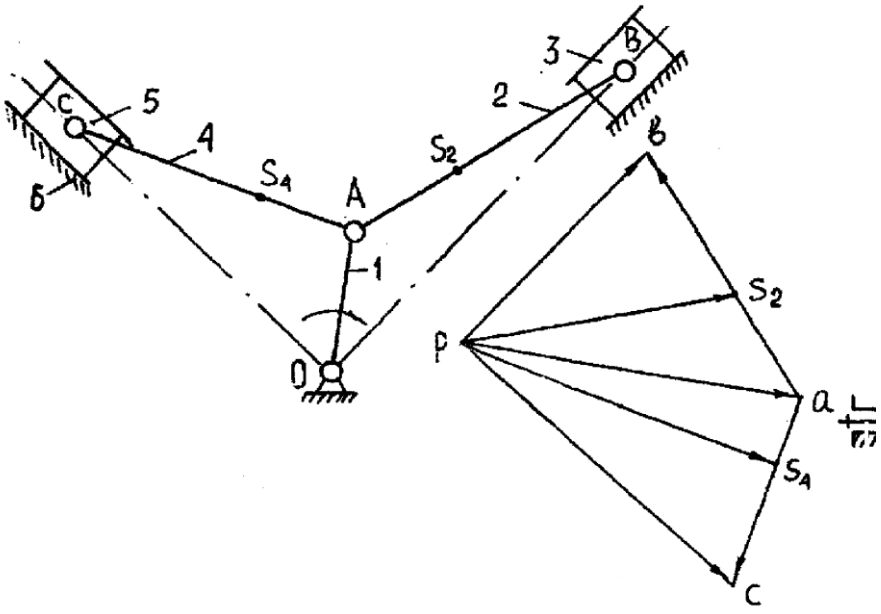
2. Link with mass m = 1,2 kg rotates with constant frequency n = 34000 rpm. Determine the inertia force which acts to the link if its Centre of gravity of link is displaced on a distance of r_S = 0,1 mm from axis of rotation.



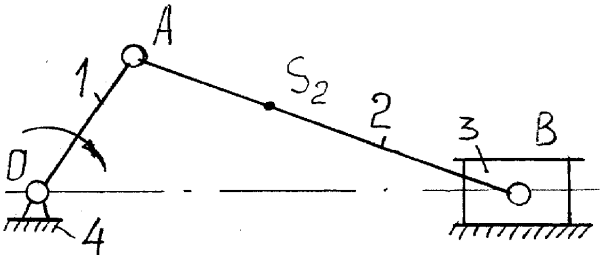
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A, B, C, S_2, S_4* (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank *1*: ω_1 = 125 s^{-1}. Links dimensions: l_{OA} = 0, 04 m; l_{AB} = 0, 16 m; l_{AC} = 0, 14 m.



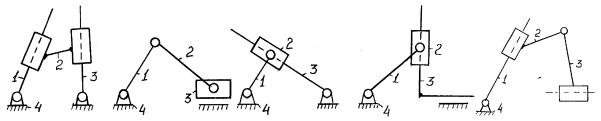
5. For a given mechanism position determine reduced moment of inertia if: m_2 = 10 kg; m_3 = 25 kg; J_{S1} = 0,5 kgm^2, J_{S2} = 1,3 kgm^2 ; ℓ_{OA} = 50 mm; ℓ_{AB} = 90mm. ℓ_{AS2} = 50 mm.



APPROVED
M. Kindrachuk.

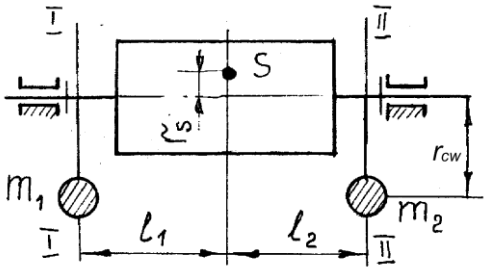
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 22

1. Which of these mechanisms is called double-slotted mechanism?

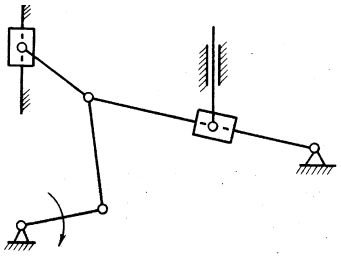


a *b* *c* *d* *e*

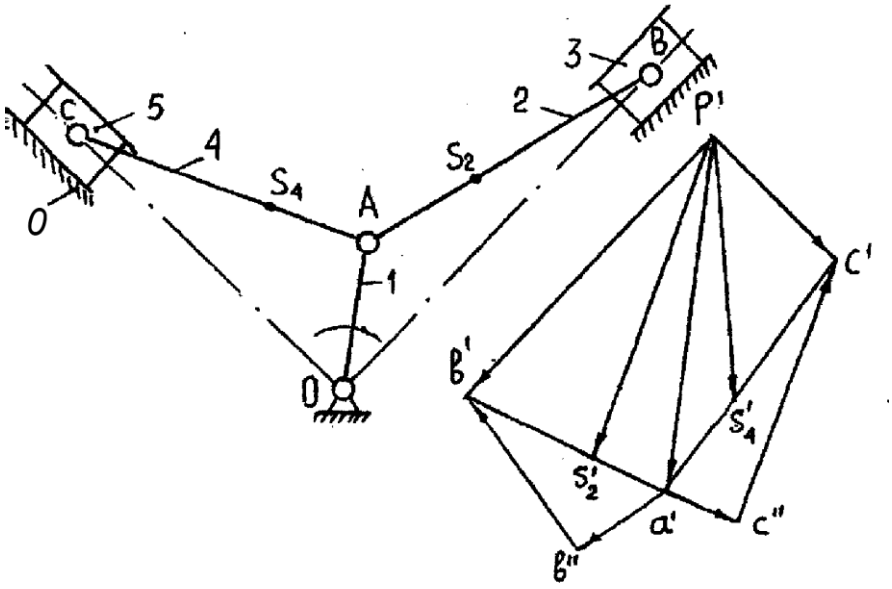
2. A rotating link is balanced by 2 counterweights m_1 i m_2, are installed on equal distances r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mass of the link m = 10 kg, distances - r_S = 1 mm; ℓ_1 = 30 = ℓ_2 = 20 cm; r_{cw} = 20 cm.



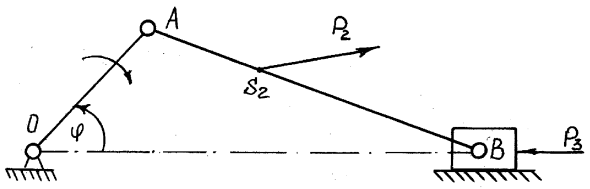
3. Determine mechanism structure



4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C*, S_2, S_4 (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank *1*: ω_1 = 125 s^{-1}. Links dimensions: l_{OA} = 0,04 m; l_{AB} = 0,16 m; l_{AC} = 0,14 m.



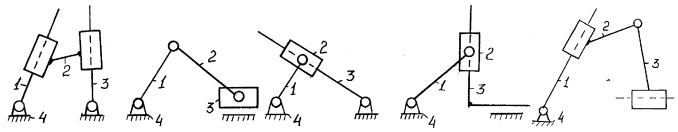
5. Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 5 N; P_3 = 8 N; φ = 60^0. Dimensions of links: ℓ_{OA} = 35 mm; ℓ_{AB} = 70mm; ℓ_{AS2} = 25mm. Centre of gravity of link AB (2) is in the point S_2.



APPROVED
M. Kindrachuk.

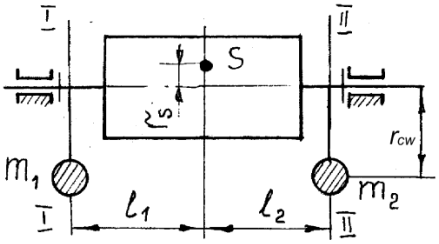
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 23

2. Which of these mechanisms is called slotted-link mechanism?

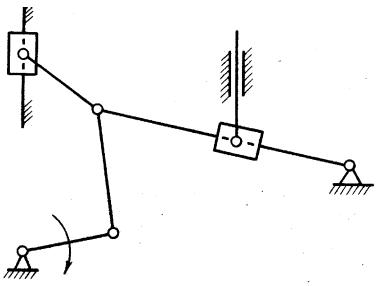


a *b* *c* *d* *e*

2. A rotating link is balanced by 2 counterweights $m_1 = m_2$, are installed on equal distances r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mass of the link m = 30 kg, distances - r_S = 2 mm; $\ell_1 = \ell_2$ = 30 cm; r_{cw} = 10 cm.

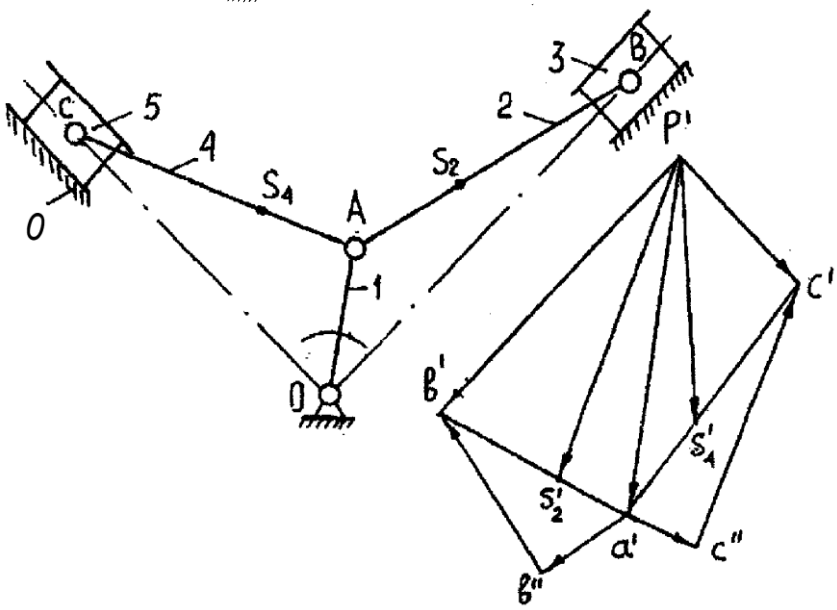


3. Determine mechanism structure



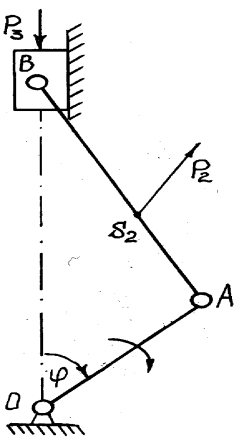
4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram

Initial data. Links dimensions: l_{AB} = 0,16 m; l_{AC} = 0,14 m. The masses of the links: m_2 = 0,9 kg; m_3 = 0,6 kg; m_4 = 0,8 kg; m_5 = 0,5 kg. Links products of inertia: J_{S2} = 0,07 kg m^2; J_{S4} = 0,06 kg m^2. μ_a = 10 m·s^{-2}/mm,



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:

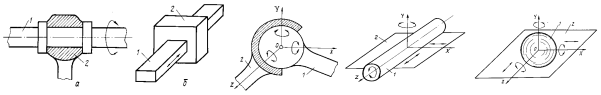
P_2 = 7 N; P_3 = 10 N; $\varphi = 45^0$. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60 mm; ℓ_{AS2} = 20 mm. Centre of gravity of link AB (2) is in the point S_2.



APPROVED
M. Kindrachuk.

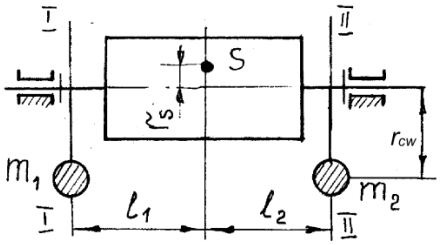
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 24

1. Which of kinematic pairs is a 5 class kinematic pair?

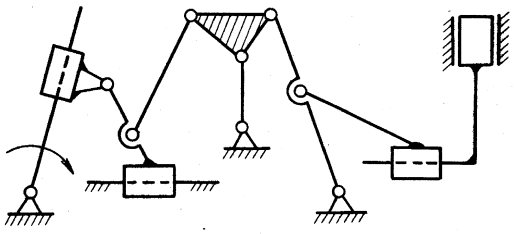


a *b* *c* *d* *e*

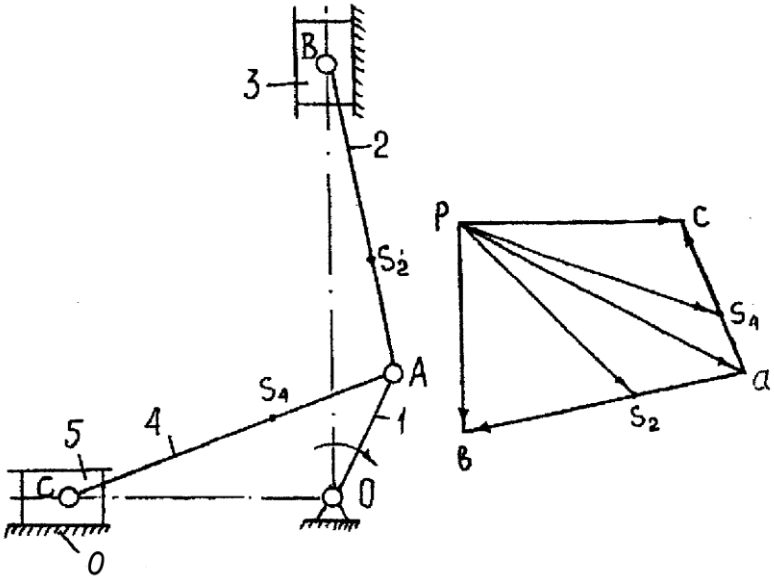
2. A rotating link is balanced by 2 counterweights $m_1 = m_2$, are installed on equal distances r_{cw} from the axis of rotation. Determine the weight of counterweights, if the mass of the link m = 30 kg, distances - r_S = 2 mm; $\ell_1 = \ell_2$ = 15 cm; r_{cw} = 20 cm.



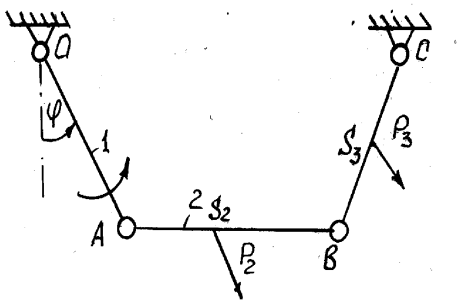
3. Determine mechanism structure



4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A*, *B*, *C*, S_2, S_4 (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of con-rods *AB* and *AS* on the diagram.
Initial data. Angular velocity of the crank *1*: $\omega_1 = 100\ s^{-1}$. Links dimensions: l_{OA} = 0,03 m; l_{AB} = 0,12 m; l_{AC} = 0,1 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 3N; P_3 = 8 N; $\varphi = 45^0$. Dimensions of links:
ℓ_{OA} = 33 mm; ℓ_{AB} = 45 mm; ℓ_{AS2} = 25 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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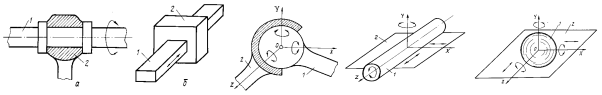
M. Kindrachuk.

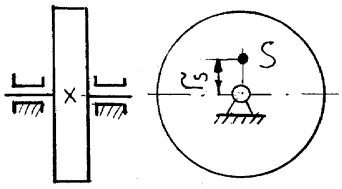
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 25

1. Which of kinematic pairs is a 5 class kinematic pair?

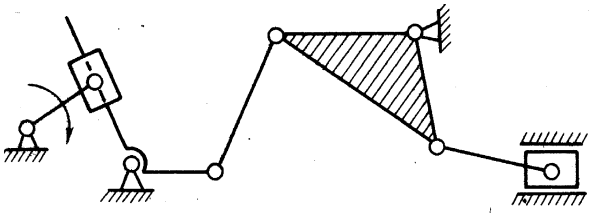


a *b* *c* *d* *e*

2. Centre of gravity of link, that rotates with constant frequency n = 20000 rpm, is displaced relative to axis of rotation on a distance r_S = 0,1 mm. Determine the mass of the link, if on it an inertia force P_i= 660 N acts..

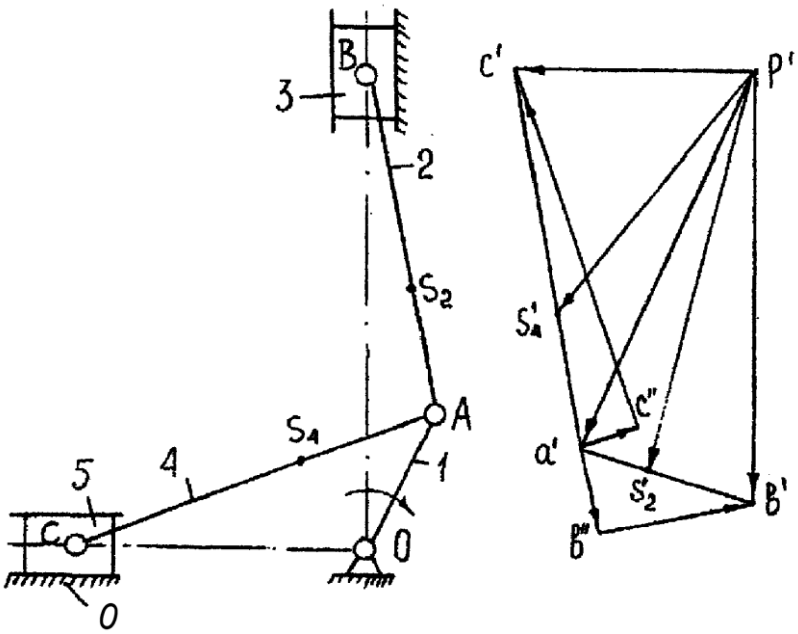


3. Determine mechanism structure

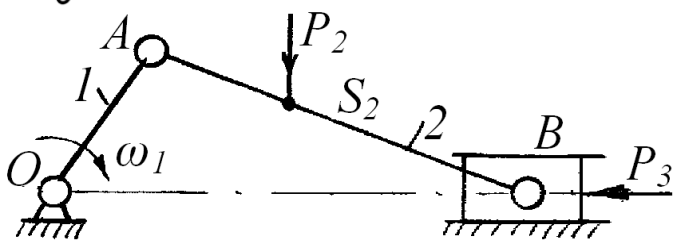


4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S*$_2$, *S*$_4$ (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram

Initial data. Angular velocity of the crank *1*: ω_1 = 100 s^{-1}. Links dimensions: l_{OA} = 0,03 m; l_{AB} = 0,12 m; l_{AC} = 0,1 m.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if: P_2 = 3 N; P_3 = 10 N; $\varphi = 60^0$. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 60 mm; ℓ_{AS2} = 20 mm. Centre of gravity of link AB (2) is in the point S_2.



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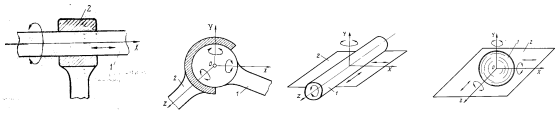
M. Kindrachuk.

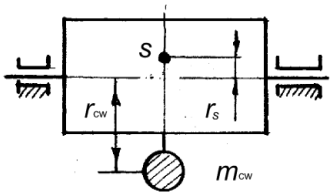
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 26

1. Which of kinematic pairs is a 4 class kinematic pair?

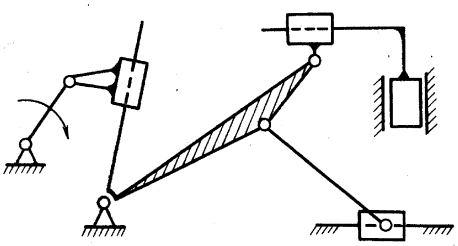


a *b* *c* *d* *e*

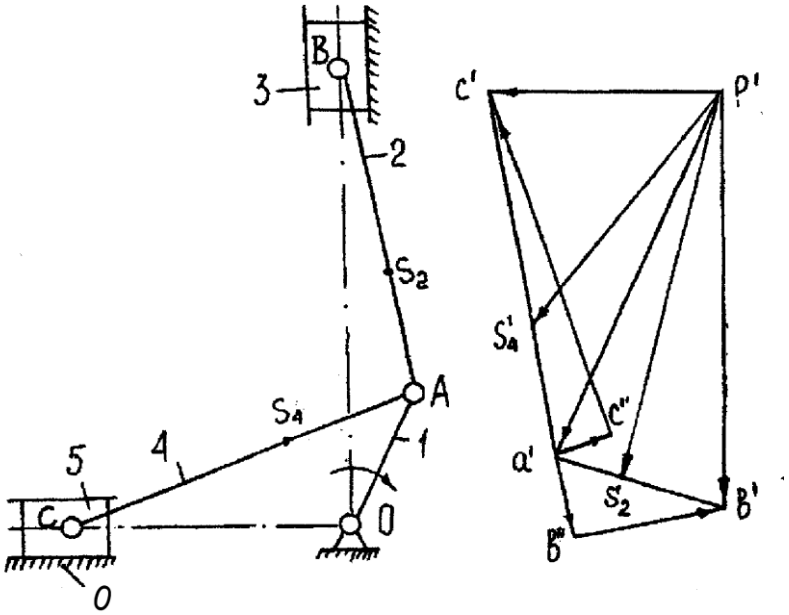
2. Link with mass m = 10 kg is statically balanced with a counterweight m_{cw} = 25 g. Determine the radius r_{cw}, if distance r_S = 0,5 mm.



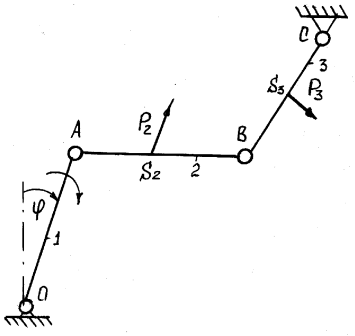
3. Determine mechanism structure



4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram. *Initial data*. Links dimensions: l_{AB} = 0,12 m; l_{AC} = 0,1 m. The masses of the links: m_2 = 0,8 kg; m_3 = 0,5 kg; m_4 = 0,6 kg; m_5 = 0,4 kg. Links products of inertia: J_{S2} = 0,0065 kg m^2; J_{S4} = 0,0055 kg m^2. μ_a = 10 m·s^{-2}/mm.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 6 N; P_3 = 10 N; φ = 30^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 50mm; ℓ_{AS2} = 25mm; ℓ_{BS} = 40 mm; ℓ_{AS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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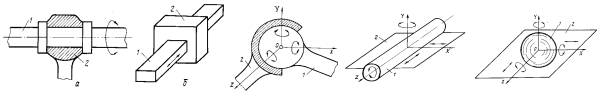
M. Kindrachuk.

Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 27

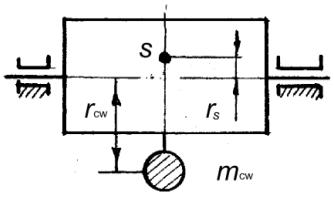
1. Which of kinematic pairs is a 4 kind kinematic pair?



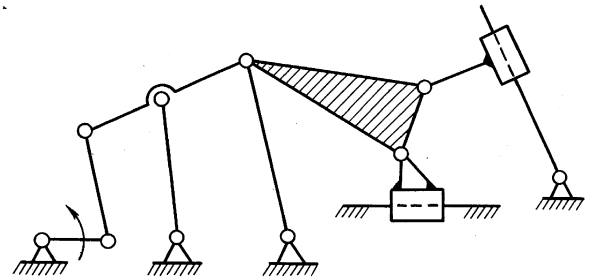
a *b* *c* *d* *e*

1) *a* 2) *b* 3) *c* 4) *d* 5) *e*

2. Link with mass m = 5 kg is statically balanced with a counterweight m_{cw} = 25 g. Determine the radius r_{cw}, if distance r_S = 0,5 mm.

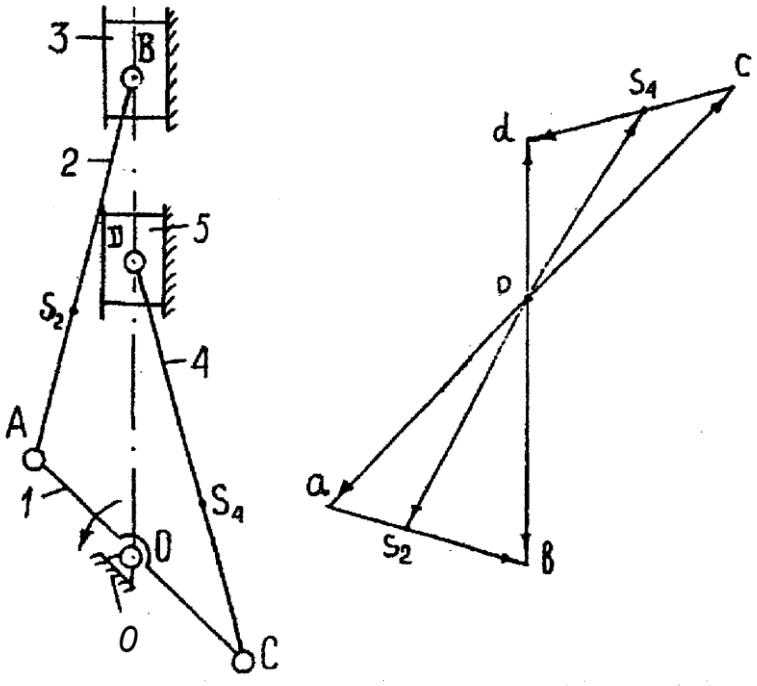


3. Determine mechanism structure

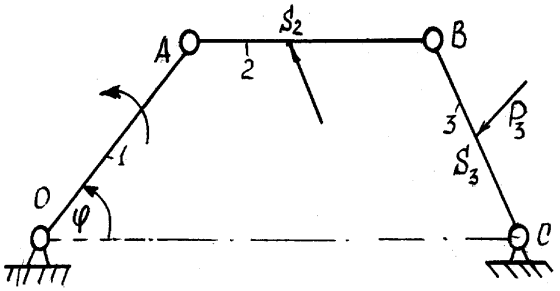


4. **Determine** scale factor μ_V by measurement of the segment $\overline{pa}$. Determine linear velocities of points *A, B, C, S_2, S_4* (V_B, V_C, V_{S2}, V_{S4}), determine and mark angular velocities ω_2 and ω_4 of conrods *AB* and *AS* on the diagram

Initial data. Angular velocity of the crank *1*: ω_1 = 80 s^{-1}. Links dimensions: l_{OA} = l_{OC} =0,075 m; l_{AB} = l_{CD} = 0,28 m.



5. Determine reduced moment of the mechanism by Zhukovskyi method if:P_2 = 8 N; P_3 = 5 N; φ = 60^0. Dimensions of links: ℓ_{OA} = 35 mm; ℓ_{AB} = 45 mm; ℓ_{AS2} = 25 mm; ℓ_{BS} = 40 mm; ℓ_{BS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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M. Kindrachuk.

Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 28

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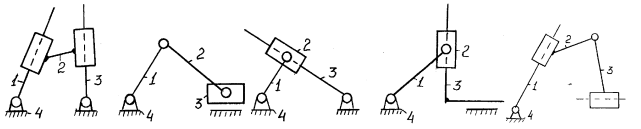
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 29

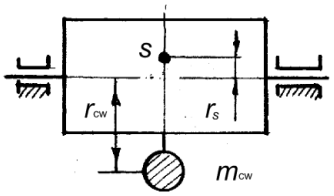
1. Which of these mechanisms is called a double-slotted mechanism ?



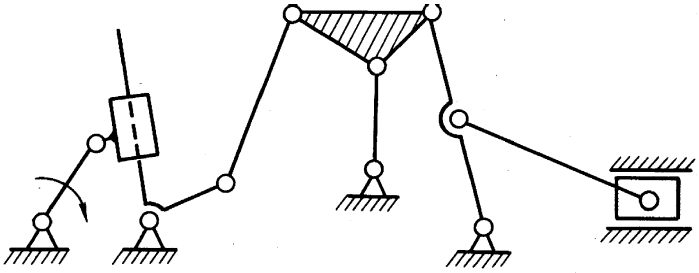
а *б* *в* *g* *д*

1) *а* 2) *б* 3) *в* 4) *g* 5) *д*

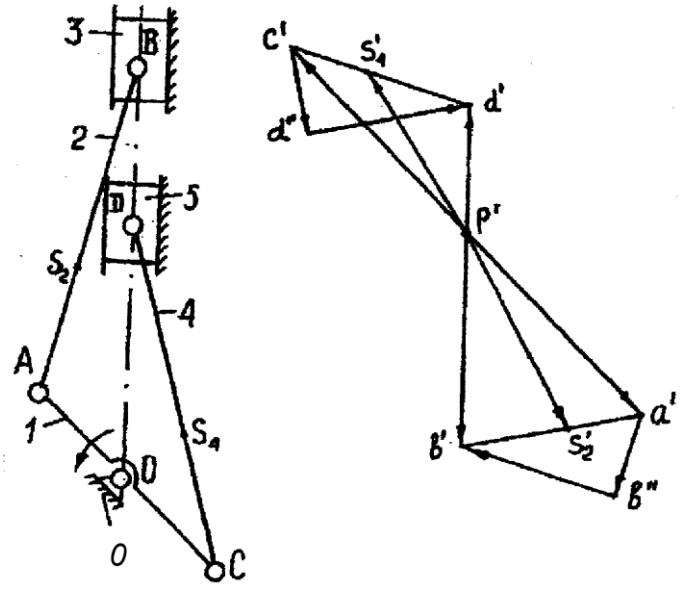
2. Link with mass m = 8 kg is statically balanced with a counterweight m_{cw} = 30 g. Determine the radius r_{cw}, if distance r_S = 0,5 mm.



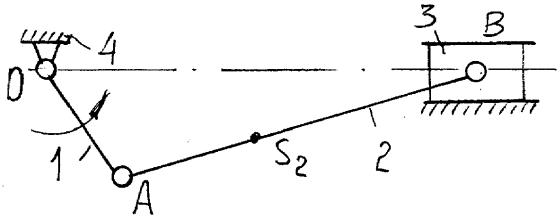
3. Determine mechanism structure



4. **Determine** acceleration scale factor μ_a by measurement of the segment $\overline{p'a'}$. Determine linear accelerations of points *A, B, C, S_2, S_4* (a_B, a_S, a_{S2}, a_{S4}). Determine tangential accelerations of points *B* and *C* relative to point *A* (a^t_{BA} and a^t_{CA}), determine and show angular accelerations ε_2 and ε_4 of con-rods *AB* and *AS* on the diagram
Initial data. Angular velocity of the crank *1*: ω_1 = 80 s^{-1}. Links dimensions: $l_{OA} = l_{OC}$ = 0,075 m; $l_{AB} = l_{CD}$ = 0,28 m.



5. For a given mechanism position determine reduced moment of inertia if: m_2 = 12 kg; m_3 = 20 kg; J_{S1} = 0,5 kgм^2, J_{S2} = 1,0 kgм^2 ; ℓ_{OA} = 40 mm; ℓ_{AB} = 80mm, ℓ_{AS2} = 30 mm.



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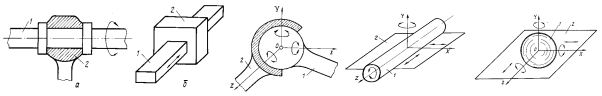
M. Kindrachuk.

Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 30

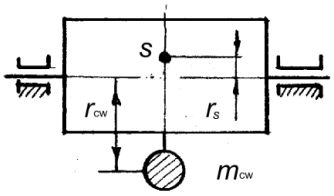
1. Which of kinematic pairs is a 4 kind kinematic pair?



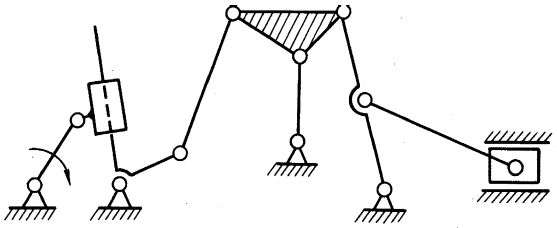
а *б* *в* *g* *д*

1) *б* 2) *д* 3) *g* 4) *а* 5) *в*

2. Link with mass m = 10 kg is statically balanced by counterweight m_{cw} = 25 g. Determine the radius of counterweight r_{cw}, if the distance r_S = 0,25 mm.

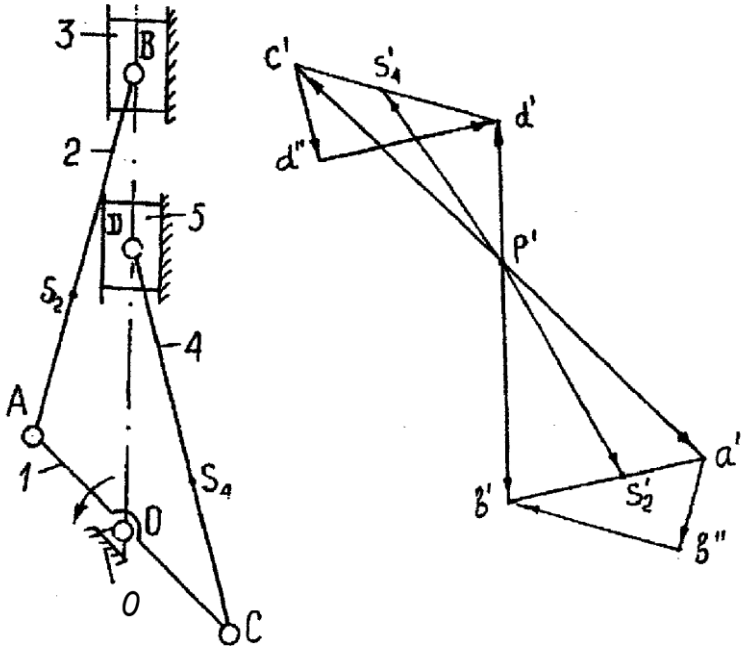


3. Determine mechanism structure



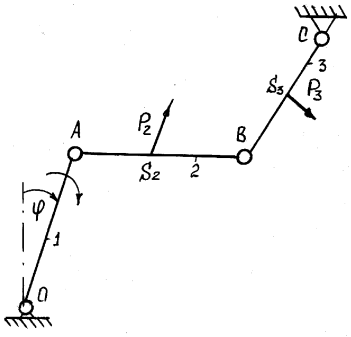
4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram

Initial data. Links dimensions: l_{AB} = l_{CD} = 0,28 m. The masses of the links: $m_2 = m_4 =$ 8,5 kg; $m_3 = m_5$ = 6 kg. Links products of inertia: $J_{S2} = J_{S4}$ = 0, 12 kg m^2. μ_a = 10 m·s^{-2}/mm.



Determine the reduced moment of the mechanism by Zhukovskyi method if:

P_2 = 6 N; P_3 = 10 N; φ = 30^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 50mm; ℓ_{AS2} = 25mm; ℓ_{BS} = 40 mm; ℓ_{AS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 31

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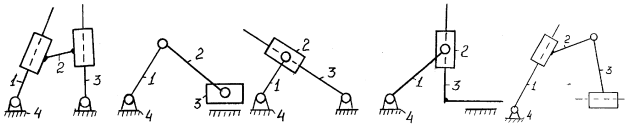
Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 32

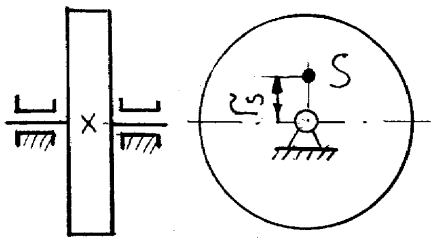
3. Which of these mechanisms is called a double-slider mechanism?



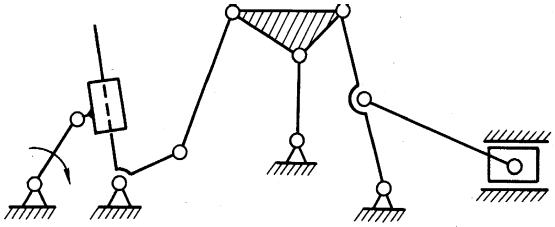
а *б* *в* *g* *д*

1) *а* 2) *б* 3) *в* 4) *g* 5) *д*

г2. Link with mass m = 0.5 kg rotates with constant frequency n = 15000 rpm. Determine the inertia force which acts to the link if its Centre of gravity of link is displaced on a distance of r_S = 0,1 mm from axis of rotation.

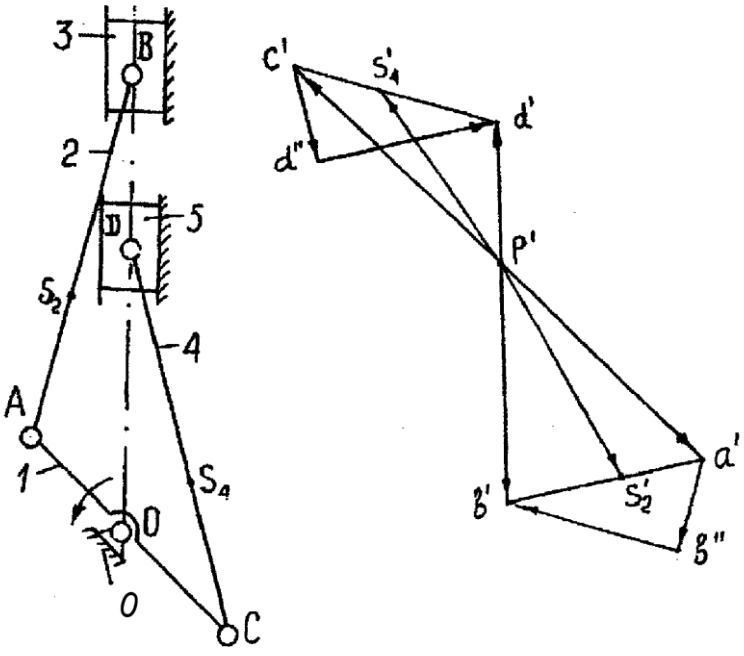


3. . Determine mechanism structure

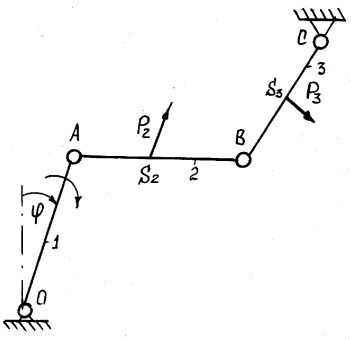


4. **Determine** inertia forces and moments of inertia forces acting to pistons *3* and *5*, con-rods *2* and *4*. The directions of inertia forces and moments should be shown on mechanism diagram

Initial data. Links dimensions: $l_{AB} = l_{CD}$ = 0,24 m. The masses of the links: $m_2 = m_4$ = 7,5 kg; $m_3 = m_5$ = 5 kg. Links products of inertia: $J_{S2} = J_{S4}$ = 0,11 kg m^2. μ_a = 10 m·s^{-2}/mm.



5. Determine the reduced moment of the mechanism by Zhukovskyi method if:
P_2 = 3 N; P_3 = 5 N; φ = 30^0. Dimensions of links: ℓ_{OA} = 30 mm; ℓ_{AB} = 50mm; ℓ_{AS2} = 25mm; ℓ_{BS} = 40 mm; ℓ_{AS3} = 20 mm Centre of gravity of link AB (2) is in the point S_2, a Centre of gravity of link BS (3) is in the point S_3.



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M. Kindrachuk.

Engineering department
Subject: Theory of mechanisms and machines
Module 1
Question card # 33