

Course	Hydraulic and Pneumatic Transmission			Date	2025/9/2	18 questions
Name		School		Class		ID

I Fill in the blanks. (20 points, 1 point for each blank)

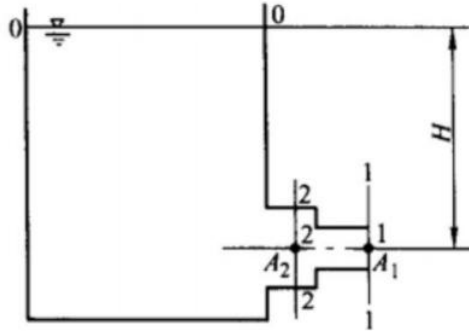
1. Hydraulic transmission systems consist of five main components, among which _____ and _____ serve as energy conversion devices. Please write out other three hydraulic components: _____, _____, _____.
2. The three basic motion equations to describe the dynamics laws in flowing fluid are _____, _____, _____.
3. The volume of a liquid changes with pressure. At a constant temperature, the relative change in liquid volume per unit increase of pressure is called the liquid's _____. _____ is the property that is easily affected by temperature.
4. In a swash-plate axial piston pump, the displacement can be varied by changing the swash plate's _____, while in a radial piston pump, the displacement can be varied by changing the _____ between the stator and the rotor.
5. The common pressure operated valves include _____, _____, _____ and pressure relay.
6. There are three basic types for speed control circuits. They are _____, _____, _____. (Hints: Speed regulating can be done by two methods, i.e., changing input flow rate or displacement)
7. The neutral function types of a four-way spool valve are diverse. When in the neutral position, if all ports are closed, hydraulic oil does not flow, the actuator is locked, and the pump is not unloaded; this neutral function is of type _____. When all ports are open, the actuator is in a floating state, and the pump is unloaded; this neutral function is of type _____.

II Short answer question items. (20 points, 5 points for each)

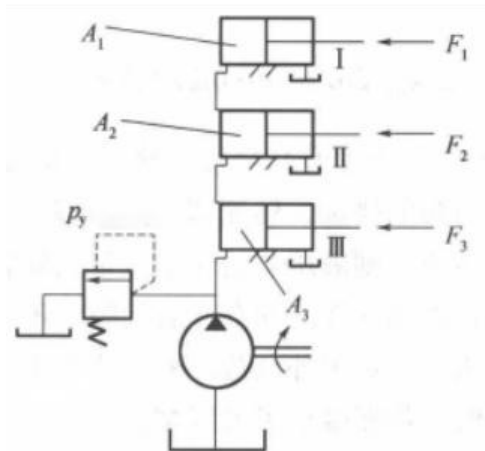
1. The British physicist Osborne Reynolds, through numerous experiments, discovered that the energy loss of liquid flow in a pipe is related to the flow state of the liquid. Please briefly describe the two flow states of liquid in a pipe and give their definitions. Also explain how to determine the flow state of the liquid.
2. Why are thin wall orifices used in throttle valves and speed-control valve?
3. Plot the characteristic curve of the pressure-limited variable pump. With reference to the curve, please explain suitable applications.
4. What is the displacement of hydraulic motor? Please explain the volumetric efficiency and mechanical efficiency of hydraulic motor?

III Calculations. (30 points, 10 points for each)

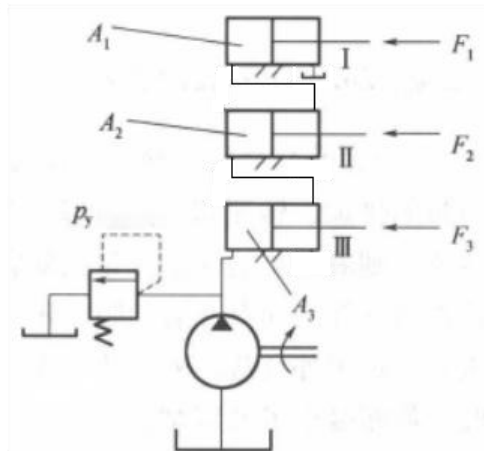
1. The is shown in the figure below, known water depth $H = 10\text{m}$, section $A_1=0.02\text{m}^2$, and section $A_2=0.04\text{m}^2$, try to find the outflow flow rate of the hole and the surface pressure at point 2 ($\alpha=1$, regardless of loss).



2. In the hydraulic system shown, the piston areas of the hydraulic cylinders are $A_1 = A_2 = A_3 = 20 \times 10^{-4}\text{m}^2$, and the rod areas of the three cylinders are $A = 10 \times 10^{-4}\text{m}^2$. The loads are $F_1 = 4000\text{ N}$, $F_2 = 6000\text{ N}$, $F_3 = 8000\text{ N}$, and the hydraulic pump flow rate is $Q = 50\text{ L/min}$. When the relief valve functions as a safety valve and is in a closed state, analyze and calculate the movement states and speeds of the hydraulic cylinders in diagrams (a) and (b).



(a)

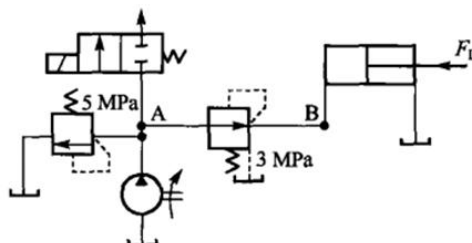


(b)

3. In the circuit shown in the diagram, the area of the cylinder chamber without the rod is 50 cm^2 , and the load F_L is 10,000 N. The set pressures for each valve are indicated in the diagram. Calculate and determine: (5 points)

(1) The pressures at points A and B when the piston is in motion; (3 points)

(2) The pressures at points A and B when the piston stops at the end of its stroke. (2 points)



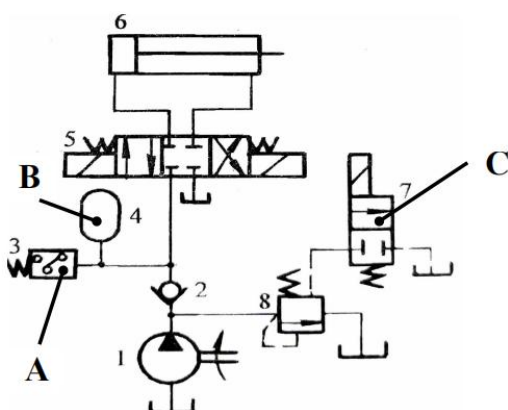
IV Diagramming question. (15 points)

(1) Please draw the symbol of hydraulic components (5 points)

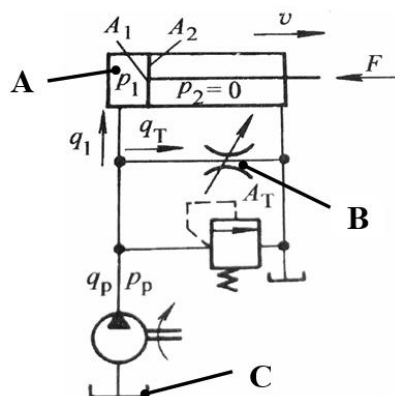
Reversible variable delivery hydraulic pumps	Direct-acting relief valve	External control internal discharged sequence valve
Speed-regulating valve	Three-position four-way hydraulic-operated directional control valve	

Please write the name of basic hydraulic circuits (4 points) and hydraulic components (6 points)

(2)



(3)



Hydraulic basic circuit	
Component A	
Component B	
Component C	

Hydraulic basic circuit	
Component A	
Component B	
Component C	

V Analysis. (15 Points)

In the hydraulic system shown in the diagram, Pump 1 is a pump with a small flow rate and Pump 2 is a large-flow-rate pump. Actuator 9 finishes autocratically in a cycle motion of “fast extends → slow extends → quick retract” respectively. Analyze the diagram and answer the following questions:

- (1) How does the system achieve the “fast extends” motion, what is the path of oil flow during this motion, and what is the name of the basic circuits used? (5 points)
- (2) How does the system achieve the “slow extends” motion, what is the path of oil flow during this motion, and what is the name of the basic circuit used? (5 points)
- (3) How does the system achieve the “quick retract” motion, and what is the path of oil flow during this motion? (5 points)

