Activity 3.2.3 Fluid Power Practice Problems

Directions

Answer the following questions. Sketch each, then label all known values. Be sure to include all steps and units throughout each solution.

All problems assume that conditions are ideal. Forces such as friction are not considered.

Problems

A pneumatic system is producing 100 lb/in.^{2} of gauge pressure. A cylinder is needed to press an adhesive label onto a product. It has been determined that 5 lb of force is optimal to complete this task.

1. Sketch and label all known and unknown values.

Sketch

2. What is the required area of the pneumatic cylinder?

Formula	Substitute / Solve	Final Answer

3. What is the required diameter of the pneumatic cylinder?

Formula	Substitute / Solve	Final Answer

A hydraulic lift system utilizes two 3 in. diameter cylinders. Workers must determine how much the system is capable of lifting before deciding how much weight can be lifted safely. The system runs at a gauge pressure of 2000 lb/in.^{2}.

4. Sketch and label all known and unknown values.

Sketch

5. What is the area of each piston?

Formula	Substitute / Solve	Final Answer

6. How much is the system capable of lifting?

Formula	Substitute / Solve	Final Answer

The gauge pressure of a pneumatic cylinder reads 20 lb/in.^{2} when the volume is 30 in.^{3}. The cylinder is compressed until the gauge reads 60 lb/in.^{2}. Assume standard atmospheric pressure (14.7 psi).

7. Sketch and label all known and unknown values.

Sketch

8. What is the absolute pressure before and after the cylinder gas is compressed?

Formula	Substitute / Solve	Final Answer

Formula	Substitute / Solve	Final Answer

9. What is the volume in the cylinder after the gas is compressed?

Formula	Substitute / Solve	Final Answer

The air temperature in a 28 in.^{3} container with a free sliding piston is initially measured at 45 °F. The temperature is raised to 200 °F. What is the new volume of the container?

10. Sketch and label all known and unknown values.

Sketch

11. What are the absolute temperature readings initially and after the temperature has been raised?

Formula	Substitute / Solve	Final Answer

Formula	Substitute / Solve	Final Answer

12. What is the volume in the cylinder after the temperature has been raised?

Formula	Substitute / Solve	Final Answer

A 60 ft³ compressor tank container has a gauge pressure of 160 lb/in.² and a temperature of 70 °F. The temperature after some time decreases to 40 °F.   Find the final pressure in the tank. Assume standard atmospheric pressure.

13. Sketch and label all known and unknown values.

Sketch

14. What are the absolute temperature readings initially and after the temperature decreases?

Formula	Substitute / Solve	Final Answer

Formula	Substitute / Solve	Final Answer

15. What is the absolute pressure of the system before the temperature decreases?

Formula	Substitute / Solve	Final Answer

16. What is the absolute pressure of the system after the temperature decreases?

Formula	Substitute / Solve	Final Answer

A flow meter is attached in a hydraulic line that measures 12 gal/min. The line has an inside diameter of 1.5 in. Find the flow velocity where the fluid passes the meter.

17. Sketch and label all known and unknown values.

Sketch

18. What is the flow rate measured as in.^{3}/min at the meter?

Formula	Substitute / Solve	Final Answer

19. What is the area of inside diameter of the line?

Formula	Substitute / Solve	Final Answer

20. What is the flow velocity where the fluid passes the meter?

Formula	Substitute / Solve	Final Answer

A hydraulic press must be used to press-fit two components together in an assembly process. The system must generate at least 775 lb of force to perform the press fit. The piston at the input cylinder is pushed with a force of 250 lb and has an area of 30 in.^{2}. The output can use up to 15 cylinders that are each 30 in.^{2}. How many cylinders are needed?

21. Sketch and label all known and unknown values.

Sketch

22. How much mechanical advantage is required to gain the necessary force?

Formula	Substitute / Solve	Final Answer

23. How many output cylinders must be incorporated into the design?