

**Goal** • Assess your understanding of the concepts you studied in Topics 4-6.

### What to Do

Carefully read the instructions before answering each set of questions.

### Fill in the Blanks

Complete the sentences in each paragraph with the correct terms.

The equation for pressure is Pressure =  $\frac{\text{Force}}{\text{Area}}$  (1) or  $P = \frac{F}{A}$  (2). The unit for pressure is newtons (3) per square metre or N/m<sup>2</sup> (4). Another name for this unit is pascal (5) or Pa. A kilopascal (6) or kPa is equal to 1000 Pa.

A hydraulic (7) lift is a mechanical system that raises heavy objects. Hydraulic systems are also considered closed (8) systems because they seal in hydraulic fluid (9). On the other hand, pneumatic (10) systems do not seal in the gas — usually air — that they use to operate.

### Multiple Choice

Circle the letter for the best answer.

11. Which of the following statements about automobile braking systems is *not* true?
- (a) As the driver pushes down on the brake pedal, the pressure that is transmitted in the brake fluid increases.
  - (b) Braking systems are “closed” systems.
  - (c) As the driver releases the brake pedal, the braking system reduces pressure by allowing brake fluid to escape outside of the system.
  - (d) Brake fluid exerts pressure on brake pads that press on a disk.
12. Sports equipment is often designed to spread the force of a blow to an athlete’s body over a larger area to reduce the chance of injury. Which sports equipment listed below does *not* do this?
- (a) boxing gloves
  - (b) helmet
  - (c) shoulder pads
  - (d) snowshoes

13. Which of the following is *not* a closed system?
- (a) human circulatory system      (c) a jackhammer  
 (b) a hydraulic lift                      (d) a backhoe
14. Which human body part is part of a pneumatic system?
- (a) heart                                      (c) lungs  
 (b) veins                                      (d) arteries
15. Which airplane part is *not* moved by a hydraulic system?
- (a) aileron                                      (c) elevator  
 (b) flap                                        (d) wing

### Short Answers

Answer each question in the space provided.

16. State Pascal's law.

pressure exerted on a contained fluid is transmitted  
unchanged in all directions, throughout the fluid, and perpendicular  
to the walls of the container

17. Imagine pushing down on a piston that has an area of 1 unit, using a force of 20 N. What is the total force on the other piston, if it has an area of 6 units? Show your calculations.

120 N

18. Draw and label a diagram to show Pascal's law at work. You can use a separate page if you need more space.

fig 4-31

**Goal** • Assess your understanding of the concepts you studied in Topics 7-8.

### What to Do

Carefully read the instructions before answering each set of questions.

### Fill in the Blanks

Complete the paragraph with the correct terms.

James watt (1) created the steam (2) engine, which was used to power locomotives. Steam is the gas (3) that is produced when water is boiled. In a steam engine, fuel such as coal (4) or wood (5) is burned to heat water in a boiler outside the engine. The steam that is produced drives a piston (6) up and down, which sets other parts in motion to move the wheels of the locomotive.

As well as powering locomotives, steam engines moved steamboats (7) along rivers. Today steam still powers ocean liners. Instead of driving pistons up and down in an ocean liner, however, the steam turns large turbines (8). The fan blades on a turbine rotates (9) when steam moves past them at high speed. This turns giant propellers (10) that drive the ocean liner through the water.

### Multiple Choice

Circle the letter for the best answer.

11. Which of these actions does *not* occur in a steam engine?

- (a) Steam expands and pushes the piston down.
- (b) Exhaust valves open to allow steam to escape.
- (c) Steam expands and pushes the piston up.
- (d) Coal or wood is burned by a boiler inside the piston.

12. Which of these parts does *not* belong to a steam turbine?

- (a) stationary blade
- (b) axle
- (c) piston
- (d) turbine wheel

13. Which of these parts does *not* belong to an internal combustion engine?

- (a) intake valve
- (b) cylinder
- (c) aileron
- (d) piston

14. Which of the following is *not* an example of mass production?

- (a) home appliances produced in a factory
- (b) the canning of foods in a food-processing plant
- (c) a person weaving a rug on a loom
- (d) the production of automobiles in an assembly plant

### Short Answers

Answer each question briefly in the space provided.

15. Throughout the last century, automobiles went through many changes in design. Discuss at least two reasons why automobile designs changed.

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16. Does society change technology, does technology change society, or do both happen? Use one specific example to explain your answer.

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**Goal** • Assess your understanding of mechanical advantage and efficiency.

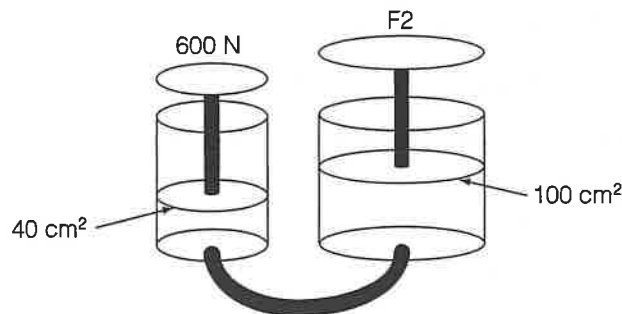
### What to Do

Carefully read the instructions before answering each set of questions.

### Multiple Choice

Circle the best answer.

- In which of the following examples is work being done?
  - A weight lifter is holding a set of barbells high overhead.
  - A tow truck is pulling a car out of a ditch using a winch.
  - A student is pushing against a locked door with all her strength.
  - Two students sit perfectly balanced on a seesaw.
- Shears are made of
  - two Class 1 levers
  - two Class 2 levers
  - one Class 1 and one Class 2 lever
  - one Class 1 and one Class 3 lever
- In the diagram below, the plunger on the left is pushed down with a force of 600 N. With how much force will the plunger on the right push up?



- 1500 N
- 240 N
- 6000 N
- 150 N

4. What is the mechanical advantage ( $MA$ ) produced by the hydraulic lift illustrated in question 3?
- (a) 6.0
  - (b) 0.4
  - (c) 2.5
  - (d) 15.0
5. Suppose that the syringe on the right in question 3 is changed to a syringe with a plunger area of  $5 \text{ cm}^2$ . How much force will it exert upward when the left syringe is depressed?
- (a) 12 000 N
  - (b) 75.0 N
  - (c) 4800 N
  - (d) 30 N
6. What would happen if a hydraulic system had a leak and lost some of its fluid?
- (a) The pressure would remain the same, but less force would be transferred.
  - (b) The pressure would be reduced, and less force would be transferred.
  - (c) The pressure would increase, and more force would be transferred.
  - (d) There would be little or no effort.
7. What happens when a gas is compressed within a closed container?
- (a) The particles get closer together, and their temperature decreases.
  - (b) The particles get closer together, and their temperature increases.
  - (c) The particles get farther apart, and their temperature increases.
  - (d) The particles get farther apart, and their temperature decreases.
8. What is the main difference between steam engines and internal combustion engines?
- (a) Steam engines do not use the combustion of fuel.
  - (b) Pistons are found only in internal combustion engines.
  - (c) In steam engines, combustion occurs externally.
  - (d) Internal combustion engines are larger.

9. How does a steam engine differ from a steam turbine?
- (a) A steam engine does not have pistons, but a steam turbine does.
  - (b) A turbine does not have pistons, but an engine does.
  - (c) They burn different types of fuel.
  - (d) Steam only pushes moving parts in the turbine.
10. The Canadian Standards Association is testing air bags. Scientists are studying how the speed of air bag inflation affects the amount of force that is transferred to the passenger. For each trial in one experiment, the same model of test car travelled at exactly the same speed and ran into the same barrier. The speed of air bag deployment varied with each trial.
- In this experiment, the independent (manipulated) variable was
- (a) the speed of the car
  - (b) the speed of air bag deployment
  - (c) the amount of force transferred to the passenger
  - (d) the number of trials in the experiment
11. Which of the variables was controlled during the experiment in question 10?
- (a) the speed of the car
  - (b) the speed of air bag deployment
  - (c) the amount of force transferred to the passenger
  - (d) the number of trials in the experiment
12. Air bags, seats, and seat belts are designed and positioned within a car to give the occupants a comfortable ride. The science that designs machines to fit people is called
- (a) biology
  - (b) economics
  - (c) ergonomics
  - (d) chiropractics
13. Air bags are usually filled with air instead of fluids, such as water. Which of the following is *not* a reason for using air in air bags?
- (a) Air is easily compressed.
  - (b) Air can be quickly injected into an air bag.
  - (c) Compressed air is lightweight and easily stored.
  - (d) An airbag does not change shape easily.

**True or False**

In the space provided, indicate whether each statement is true (T) or false (F). If you think that a statement is false, rewrite it to make it true.

T 14. The part of a lever on which the lever arm pivots is called the fulcrum.

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F 15. A winch is designed to move loads more quickly.

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T 16. The follower gear always turns in the direction opposite to that of the gear driving it.

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F 17. When a chain connects two sprockets, they turn in opposite directions.

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18. Put a D beside the descriptions that are true of a diesel engine. Put a G beside the descriptions that are true of a gasoline engine.

G (a) ignites fuel with a spark

D (b) mixes fuel and oxygen inside the cylinder

D (c) causes fuel to self-ignite when compressed

G (d) mixes fuel and oxygen outside the cylinder

D (e) produces more power

D (f) burns fuel more efficiently

G (g) produces less power

G (h) burns fuels less efficiently