

Checkups and follow-ups

CHAPTER 13 ANSWER KEY

ST
Questions 1, 2, 4, 7–13, 15–17, A, C and E

Mechanical engineering

Checkup

1 WHAT IS MECHANICAL ENGINEERING? (p. 426)

1. Name the branch of science and technology that focuses specifically on the study of technical objects with moving parts.

Mechanical engineering

2 LINKING IN TECHNICAL OBJECTS (pp. 427–430)

2. Look at the bicycle opposite.

- a) Name the four characteristics of the link between the tires and their respective wheels. Explain each characteristic.

Direct, because there is no linking component between the two parts.

Flexible, because the surface of the tire can be deformed.

Removable, because it is possible to separate the two parts without damaging them.

Complete, because it prevents the independent motion of one of the two parts.



- b) Name the four characteristics of the link between the brake housing and lever. Explain each characteristic.

Indirect, because there is a linking component between the two parts (the bolt).

Rigid, because the surfaces of the two parts cannot be deformed.

Removable, because it is possible to separate the two parts without damaging them.

Partial, because the brake lever can move independently.

- c) Name the characteristics of the link between the crossbar and the head tube. Explain each characteristic.

Indirect, because there is a linking component between the two parts (the welding).

Rigid, because the surfaces of the two parts cannot be deformed.

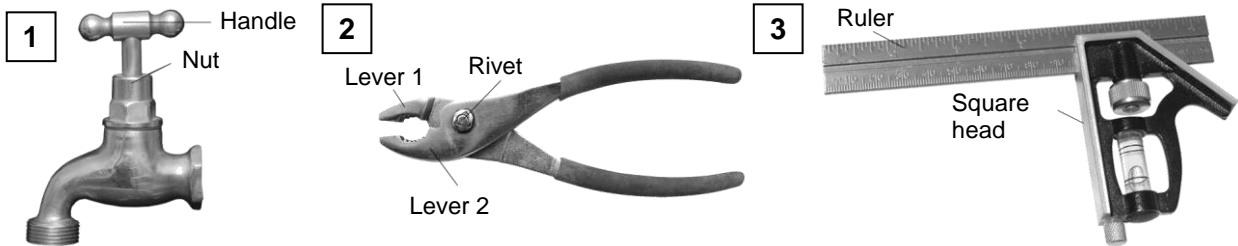
Non-removable, because it is impossible to separate the two parts without damaging them.

Complete, because it prevents the independent motion of one of the two parts.

⇒ Question 3 is not intended for students in the ST program.

3 GUIDING CONTROLS (pp. 431–435)

4. Look at the three objects below.



- a) For each of the three objects, name the type of guiding involved.

Faucet: helical guiding

Pliers: rotational guiding

Combination square: translational guiding

- b) Identify the guiding component in each object.

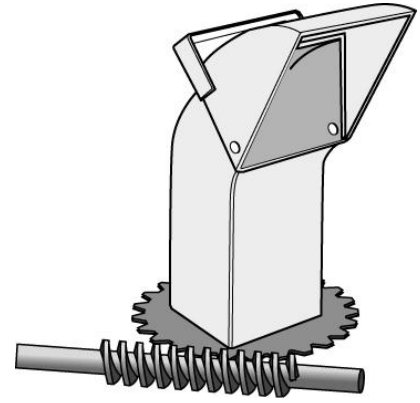
Faucet: a nut

Pliers: a rivet

Combination square: a ruler

⇒ Questions 5 and 6 are not intended for students in the ST program.

4 MOTION TRANSMISSION SYSTEMS (pp. 435–445)



7. The motion transmission system opposite is used to direct the chute of a snow blower.

a) What is this type of motion transmission system called?

A worm and worm gear system

b) Name the driver component in this system. What colour is it in the illustration? (See the colour illustration in the student book, p. 451.)

The driver component is the worm (screw), which is red in the illustration.

c) Name the driven component in this system. What colour is it in the illustration? (See the colour illustration in the student book, p. 451.)

The driven component is the worm gear, which is blue in the illustration.

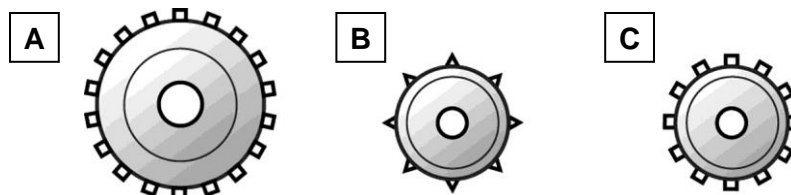
d) Does the system contain an intermediate component? If so, what is it called?

This system does not contain an intermediate component.

e) If the snow blower user decides to turn the chute manually, the motion transmission system could be damaged. Explain your answer.

If force is applied to the chute to direct it, the worm gear will be forced to act as the driver of the motion transmission system. However, the driver of a worm and worm gear system is always the worm, and this type of system is irreversible. Trying to force it to reverse could therefore break it.

8. Antonia is asked to build a gear train using two of the gears illustrated below.



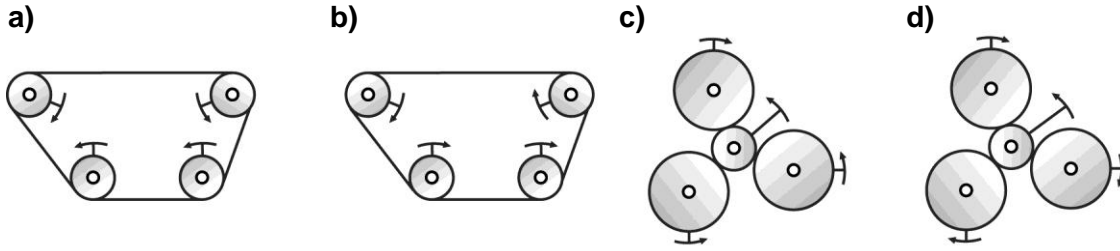
a) Which gears should she choose for her system?

Gears A and C

b) Which characteristic of the gears would motivate her choice?

The shape of the teeth

9. Among the motion transmission systems below, identify those whose rotational motions are correctly illustrated.



Systems b) and d)

10. Look at the mechanism opposite.

a) Which type of motion transmission system is used in this technical object?

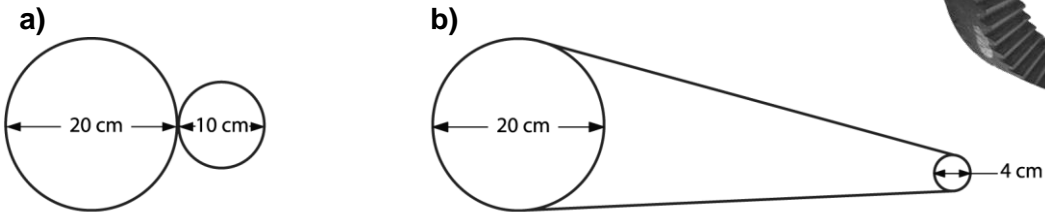
A gear train

b) Which type of gear is used in this system?

Bevel gears



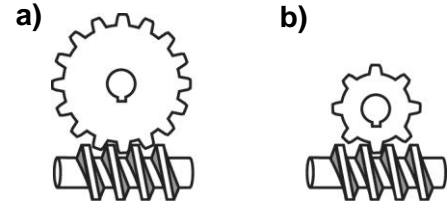
11. Based on the information provided, calculate the ratio of the gear speeds for each of the motion transmission systems below.



In a), the ratio of the gear speeds from the larger gear to the smaller gear is 2:1. In b), the ratio from the larger pulley to the smaller pulley is 5:1.

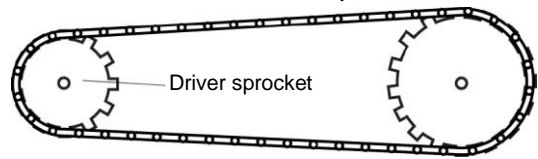
12. Look at the two worm and worm gear systems opposite. In which system will the rotational speed be more greatly reduced? Explain your answer.

The reduction in speed will be greater in system a) because the worm gear in this system has more teeth than the gear in system b).



13. In the chain and sprocket system below, the rotational speed of the driver sprocket is 60 revolutions per minute. Based on the information provided by the illustration, calculate the rotational speed of the other sprocket. Express your answer in revolutions per minute.

The rotational speed of the driven sprocket is 45 revolutions per minute.



⇒ Question 14 is not intended for students in the ST program.

5 MOTION TRANSFORMATION SYSTEMS (pp. 445–449)

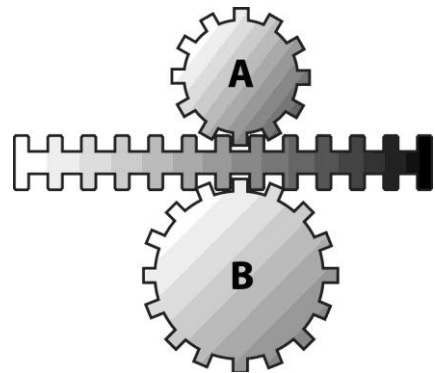
15. Look at the motion transformation system opposite.

- a) What is this type of motion transformation system called?

A rack and pinion system

- b) Which of the two gears will turn faster? Explain your answer.

Gear A will turn faster because it has fewer teeth.

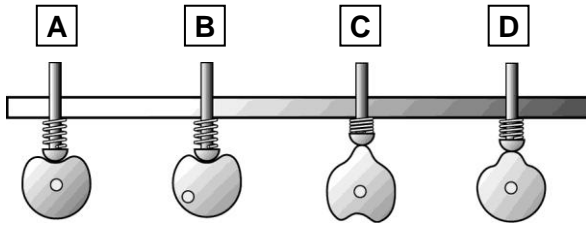


16. A tensioner is used to tighten the wire or rope of a clothesline, as in the illustration opposite. Which type of motion transformation system is at work here?

A screw gear system



17. Look at the motion transformation systems below.



a) What are these motion transformation systems called?

Cam and follower systems

b) What does the spring do in these systems?

It ensures the constant pressure of the follower on the surface of the cam or the eccentric.

c) In which of the four systems will the rod rise the highest?

In system B

REVIEW QUESTIONS

⇒ Questions B and D are not intended for students in the ST program.

A. Look at the bottle of correction fluid opposite.

a) Name the characteristics of the link between the cap and the brush stem.

Direct, rigid, non-removable and complete

b) Name the characteristics of the link between the cap and the bottle.

Direct, rigid, removable and partial

c) Which part acts as a guiding control in this object?

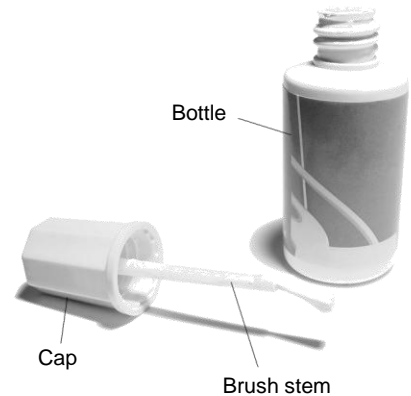
The bottle (more specifically, the mouth of the bottle)

d) Which type of guiding is involved?

Helical guiding

e) What characteristic of the guiding component controls the guiding?

Its threads



C. Glue sticks are among the most popular types of glue. In the tube, the glue stick is attached to a nut. Twisting the screw at the base of the tube will make the glue stick move up or down.



a) What is the usual mechanical function of glue in technical objects?

Linking

b) Which part guides the glue stick motion, and which type of guiding is involved?

The tube acts as the guiding component. It guides the glue stick in a translational motion.

c) Is the system for raising or lowering the glue stick a motion transmission system or a motion transformation system? Identify the type of system at work.

It is a motion transformation system—specifically, a screw gear system.

d) Name the four characteristics of the link between the cap and the tube.

Direct, rigid, removable and partial

E. Prepare your own summary of Chapter 13 by building a concept map.

See the Concept maps section in Guide B.

Follow-up

1. Why is the mechanical energy from an electric motor considered “greener” than energy from a combustion engine? Give at least two reasons.

Answers will vary. Example: The mechanical energy from an electric motor does not emit greenhouse gases and does not require the extraction and transportation of fossil fuels.

2. How can you counteract the harmful effects of combustion engines when you choose a means of transportation? Give several examples.

Answers will vary. Examples: by opting for public transit or car-pooling when possible

– by respecting the speed limit on the road

– by making sure that car tires are properly inflated.