

Describing the technical aspects of devices on the example of Segway.

Part 1 – Listening comprehension

Watch the film on the following link: <https://www.youtube.com/watch?v=rmlg5QkusFQ> entitled “How Segway works” and do the exercises below.

Exercise I. Complete the gaps in the sentences.

1. The Segway is an electric scooter with _____ wheels.
2. As you _____ forward gravity wants to take you down.
3. Even when keeping it _____, you're really falling forward one moment and backward the next.
4. 5 _____ rate sensors detect changes in direction and speed.
5. And _____ sensors detect angles.
6. The liquid inside _____ an electrical signal, it sends the _____ to the wheels and keeps you _____.
7. The Segway has _____ microprocessors giving it about three times the _____ of a typical PC.
8. To turn, push the _____ to one side.
9. This _____ power to the inside wheel, _____ the outside one faster and round you go.
10. Each wheel comes with its own two-horsepower _____ electric motor.
11. _____ inside the wheel _____ step down the motor's RPM for smooth control and a _____ whirring sound.
12. The gears also help limit the Segway's speed to about _____.

Exercise II. Answer the questions.

1. How do you turn, accelerate, decelerate and reverse the Segway?
2. What kind of sensors do they have?
3. What is its carrying capacity?
4. What are the possible applications of Segway?
5. What does RPM stand for?

Part 2 – Reading comprehension

Read the text below and do the following exercises.

The Segway PT is comprised of an intelligent network of sensors, mechanical components, a drive system and a steering system. From the moment the driver stands on the vehicle, five gyroscopic sensors and two acceleration sensors begin to analyse the terrain and body position one hundred times per second.

The brain consists of two redundant electrical circuit boards, which are respectively fitted with a group of microprocessors. The battery and motor winding are also redundant. They work together to share to the necessary propulsion of the workload. The Segway also has other additional microprocessors. The vehicle requires this much computing capacity because precise steering calculations must be carried out in the shortest possible time to prevent toppling. If a circuit board or the associated battery, motor winding or wiring fails during the

drive, the other redundant system takes over all functioning. The system informs the driver about defects and initiates a controlled stop.

The microprocessors utilise advanced software that steers the vehicle. The program monitors all information that reaches it from the gyroscopic sensors and adjusts the speed of the electric motors accordingly.

Technical specifications

1. **Top speed:** 12.5 miles per hour (_____ kph). This is about three times typical walking speed.
2. **Weight:** 83 lbs (_____ kg)
3. **Width:** The Segway's footprint (how much space it covers on the ground) is 19 by 25 inches (_____ by _____ cm). This makes the Segway about the same width as an average size person, so it doesn't take up much space on the street. The platform is 8 inches (_____ cm) off the ground.
4. **Weight capacity:** 260 pound (_____ kg) rider and cargo.
5. **Range:** About 17 miles (_____ km) on even ground, with a single charge on a lithium-ion (Li-ion) battery, and 8-12 miles (_____ - _____ km) with a single charge on a NiMH (nickel metal hydride) battery.
6. **Driver interface:** The Segway has a small LCD screen that tells the driver how much battery power is left and how well the vehicle is functioning.
7. **Motors:** Each of the Segway's wheels is driven by a 2-horsepower electric motor that produce no emissions.
8. **Computer:** The Segway's brain is made up of two circuit boards, housed in the vehicle's chassis. The circuit boards, which have a total of 10 microprocessors, normally work together, but each can function independently in the event of a computer problem. If one breaks, the other circuit board will slow the vehicle down gradually to avoid an accident.
9. **Power:** The Segway is powered by two rechargeable batteries. Segways come with either lithium-ion (Li-ion) or nickel metal hydride (NIMH) batteries. The batteries can be recharged with household AC current.
10. **Sensors:** The Segway uses five gyroscopes and a collection of other tilt sensors to keep itself upright. Only three gyroscopes are needed - the extra sensors are included as a safety precaution. The Segway has an additional weight sensor built into its platform to tell the computer when a rider has stepped on.
11. **Brakes:** The Segway doesn't have a braking system. To stop, the rider stands upright without leaning forward or backward, and the vehicle maintains its position.
12. **Turning radius:** Since it only has two wheels, the Segway can rotate around a single axis (the wheels turn in opposite directions). This gives the Segway a turning radius of zero.
13. **Wheels:** The Segway wheel consists of a forged steel wheel hub with a glass-reinforced thermoplastic rim. Each wheel is secured to the drive shaft with a single nut. The tires are made of a silica compound, which provides good traction even on wet surfaces.
14. **Security:** The Segway uses an electronic key system. The key, which looks something like a car lighter, stores a 128-bit encrypted digital code. The vehicle won't start unless the key is plugged into its port. The key can also store settings for vehicle operation.
15. **Chassis:** The Segway's sensitive electronic equipment is housed in a sturdy die-cast aluminum chassis which can withstand 7 tons of force.

Exercise 1. Match the English words with their Polish translations.

1. traction	a) piasta
2. redundant	b) ślad
3. propulsion	c) środek ostrożności
4. hub	d) solidny
5. rim	e) przyczepność
6. footprint	f) pionowy
7. precaution	g) felga
8. upright	h) niezależny
9. sturdy	i) związek chemiczny
10. compound	j) napęd

Exercise 2. Match the words from the two columns to make word collocations.

1. electrical	a) capacity
2. mechanical	b) speeds
3. steering	c) batteries
4. computing	d) precaution
5. advanced	e) circuit
6. rechargeable	f) board
7. varying	g) components
8. circuit	h) steel
9. safety	i) system
10. forged	j) software

Exercise 3. Find the English translations to the words given in Polish.

1. oś	
2. promień	
3. wychylać się do przodu	
4. wychylać się do tyłu	
5. obracać się	
6. podwozie	
7. wytrzymać	
8. powierzchnia	
9. wzmocniony	
10. spowalniać	

Exercise 4. Answer the questions.

1. What are the basic components of Segway?
2. Which elements are redundant? Why?
3. What kind of sensors is the device equipped with?
4. Why can circuit boards function independently?
5. Which function gives the Segway a turning radius of 0°?
6. What are the wheels made of?

Grammar.

Read the sentences below. Answer the questions.

1. The Segway uses five gyroscopes and a collection of other tilt sensors to keep itself upright.

What tense is used in the sentence? Why? What kind of activity does it express?

2. Only three gyroscopes are needed - the extra sensors are included as a safety precaution.

What is the name of this grammatical form? What is it used for? Find 5 more examples in the text.

3. The program monitors all information that reaches it from the gyroscopic sensors and adjusts the speed of the electric motors accordingly.

Why is the noun used in the singular form? Name 5 more nouns of this type.

Metric system versus Imperial system. Complete the table with the correct numbers and SI units.

Numbers	SI units
3,7854, 1,6093, 28,35, 4046,9, 2,54, 6,3503, 0,3048, 0,4732, 32, 0,9144, 0,4536	kg, liters, cm, °F, g, m, kg, m, liters, m ² , km,

Imperial units	International System of Units (SI)
Length	
1 inch	
1 foot	
1 yard	
1 mile	
Weight	
1 ounce (oz)	
1 pound (lb)	
1 stone	
Area	
1 acre	
Capacity	
1 pint	
1 gallon	
Temperature	
	0°C

Return to the text. Read points 1-5 of Technical specifications and complete the SI data in brackets.

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