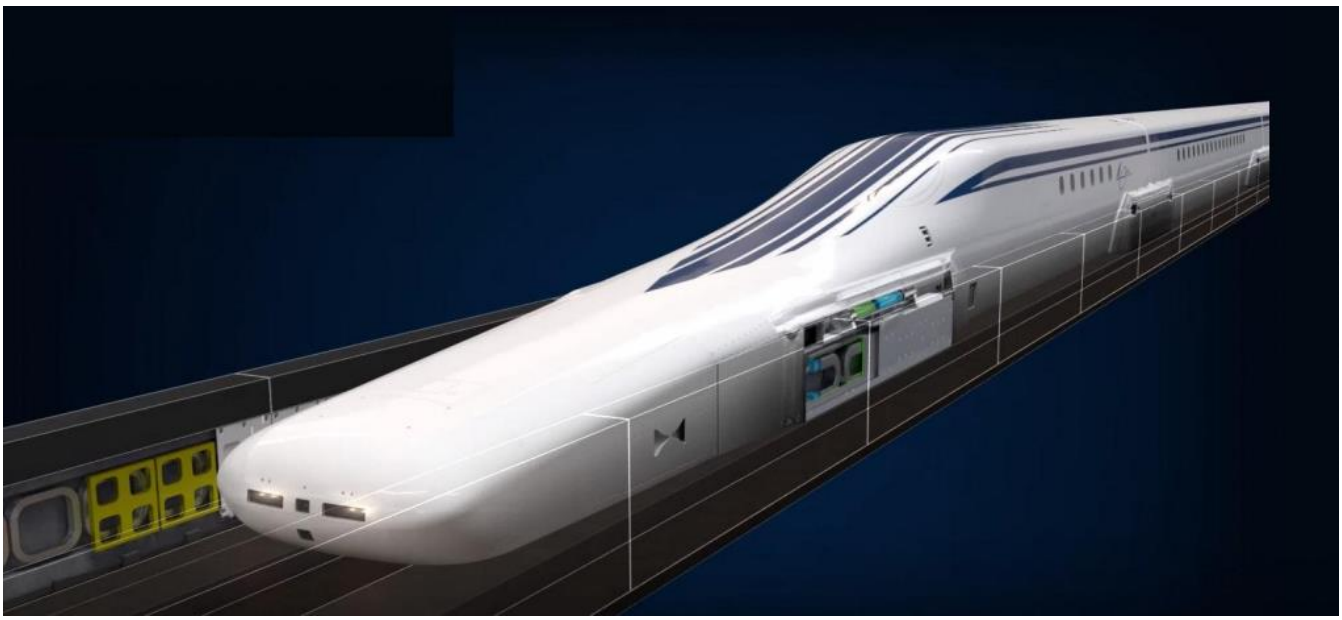
Secrets of SCMAGLEV

Name :

New high-speed train



1 This is a picture of SCMAGLEV. Write down all the things you notice and think about when you see this picture.

Let's compare it with the Shinkansen in Japan

New high-speed train

About the vehicle

Maximum operational speed : 500km/h(311mph)
Passenger capacity : Up to 24 for leading cars and up to 60 for middle cars
Car length : 28m for leading cars and 24.3m for middle cars
Car width : 2.9m
Car Height : 3.1m
Car material : Aluminum alloy
Weight : Approx. 25t (for one middle car) <Equivalent to 3.5 elephants!>

Note: These are specifications for Yamanashi Maglev Line, and not for the vehicles for commercial operation.

-SCMAGLEV is a unique Japanese technology.
-Levitates approx. 10 cm
-Runs at 500 km/h

There are no rails, but a U-shaped structure called a “guideway”, inside which the vehicle operates using the force of magnets.

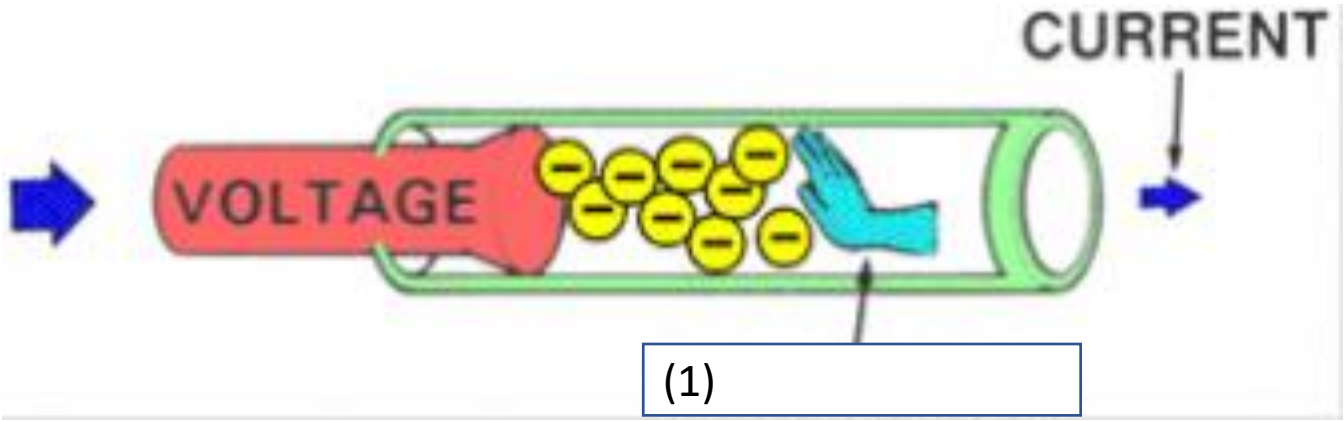
SCMAGLEV is automated and has no driver.
However, there are plans to have the necessary crew on board to provide onboard services and respond to abnormal situations.

What is superconductivity?

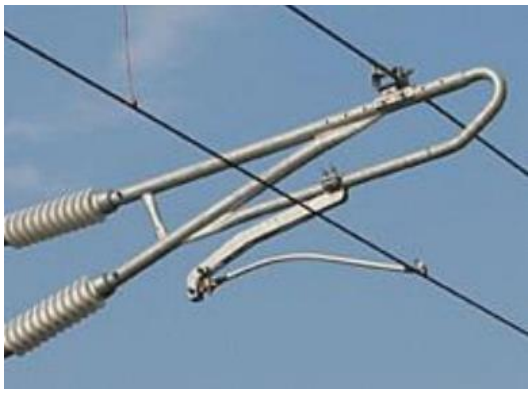
2 To complete each item, choose the best word from the two options.

(1) _____ is the hindrance to the flow of electrons in material.

(a) Resistance **(b) Conductance**



Extra Facts



○ Electricity flow

The ease with which electricity flows through the main metals is **Copper** → **Gold** → **Aluminium** → **Iron**. Copper is used in railway overhead wires because it conducts electricity easily. Conversely, nichrome conducts electricity less easily. When electricity is passed through these metals, a lot of heat is generated.

What is superconductivity?

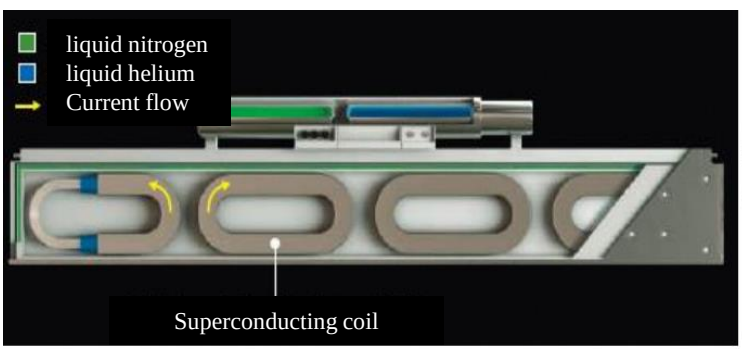
3 Read each passage and choose the best word from among the following choices for each blank.

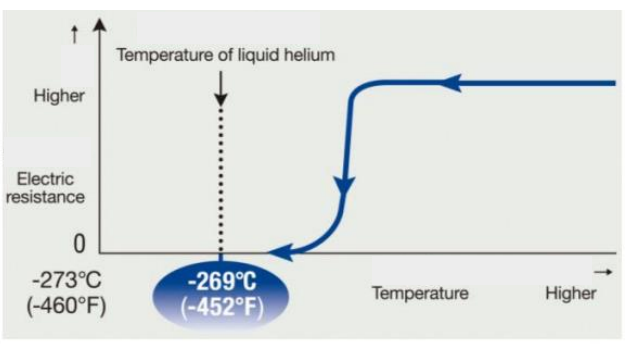
・SCMAGLEV runs by using the force of powerful magnets and therefore (1) , which utilise the phenomenon of superconductivity.

・ Superconducting magnets use a (2) as the superconducting material and cool it to minus (3) with liquid helium, resulting in zero electrical resistance and (4) electricity flow.

・ By maintaining a stable superconducting state, the magnets are more powerful without energy loss due to (5)

(a) Superconducting magnets (b) Permanent magnet
(c) 269℃ (d) 186℃ (e) Semi-permanent (f)Temporary
(g) Heat emission (h) Luminescence
(i) Niobium-titanium alloy (j) Aluminium





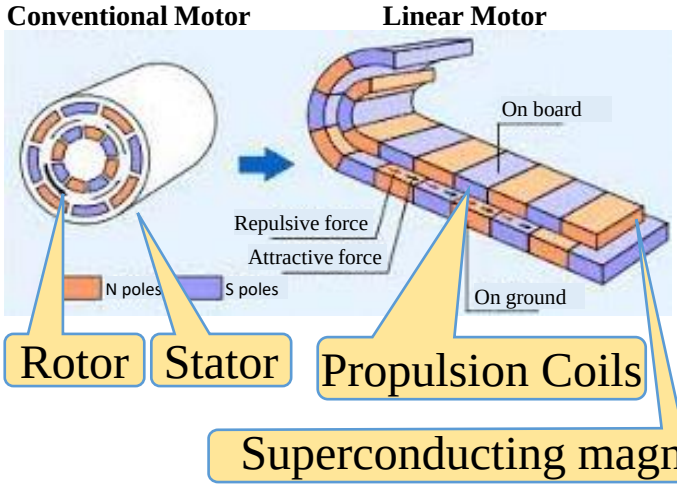
Mechanism of linear motors

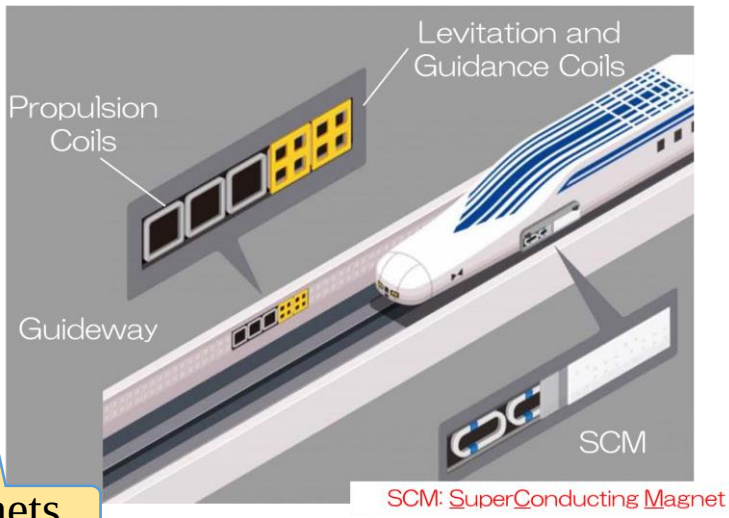
4 Read each passage and choose the best word from among the following choices for each blank.

・ Linear motors are conventional rail vehicle motors stretched in a (1) ＿＿＿＿＿＿

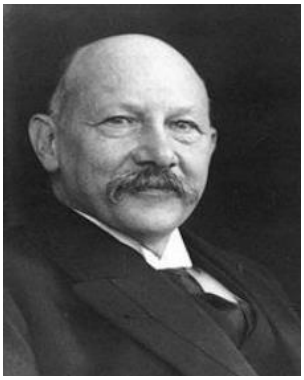
・ In the SCMAGLEV, the inner rotor of this linear motor corresponds to the superconducting magnet mounted on the (2) ＿＿＿＿ and the outer stator to the (3) ＿＿＿＿＿＿ installed in the guideway (track) above ground.

(a) Straight line (b) U-shaped (c) Vehicle
(d) Ground (e) Propulsion coil (f) Track





Extra Facts

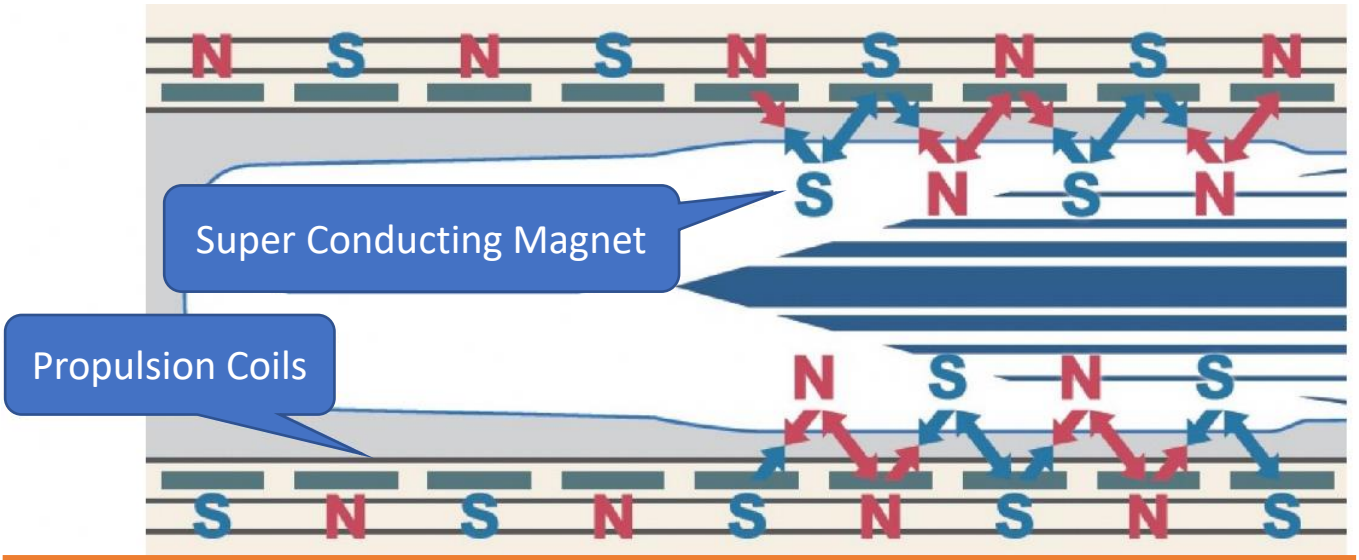


In 1911, Heike Kamerlingh Onnes in the Netherlands reported a phenomenon in which when mercury was cooled with liquid helium, its electrical resistance suddenly dropped to almost zero. The Nobel Prize in Physics was awarded in 1913 for the liquefaction of helium and the discovery of superconductivity.

Mechanism of SCMAGLEV forward

5

Read each passage and choose the best word from among the following choices for each blank.



The (1) in the vehicle have alternating N and S poles. The (2) on the ground are fed with current from the substation to switch between N and S poles. This causes an (3) force between the (4) and S poles and a (5) force between the N and N poles between the vehicle and the coils, propelling the vehicle forward.

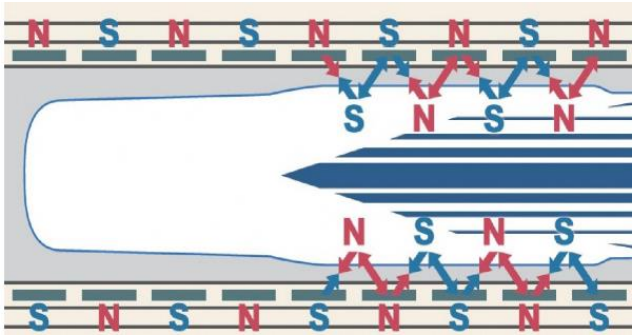
(a) Electromagnets (b) Superconducting magnets
(c) Propulsion coils (d) S poles (e) N poles
(f) Attractive (g) Levitate (h) Repulsive

6

Which direction is it going?

(a) ⇦

(b) ⇨



Mechanism of SCMAGLEV levitation

7 To complete each item, choose the best word from among the two choices.

Conventional trains produce (1) between the wheels and rails while operating. This limits maximum speed because the wheels slip when moving very fast.
The maglev concept overcomes this limitation by levitating the train above the track.

(a) Slip **(b) Grip**

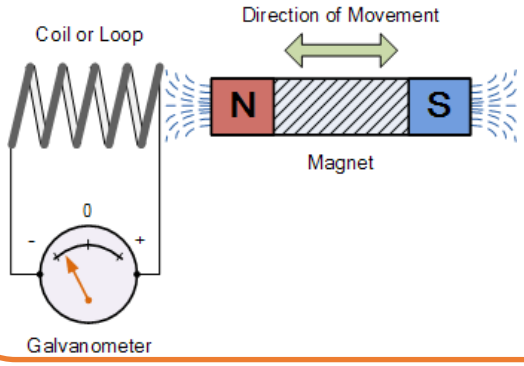
8 To complete each item, choose the best word from among the three choices.

It drives on rubber wheels when travelling at a low speed. When the speed exceeds approx. 150km/h(93mph), the train levitates by (1) cm, storing the rubber wheels in its body.

(a) 1 **(b) 10** **(c) 50**

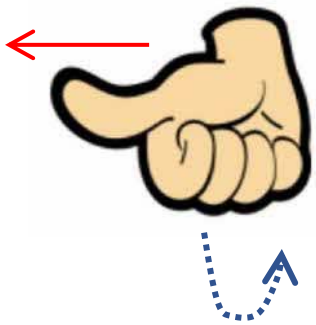
Mechanism of SCMAGLEV levitation

9 Read each passage and choose the best word from among the following choices for each blank.



Electromagnetic induction

When a conductor (permanent magnet is placed near a coil or a single loop of wire, it induces an Electromotive Force or emf, also known as a Voltage, and therefore a current is produced.



Corkscrew rule

The magnetic field made by a current in a straight wire curls around the wire in a ring. You can find it by pointing your right thumb in the direction of the current in the wire and curling your fingers. Your fingers will be curled in the same direction as the magnetic field around the wire.

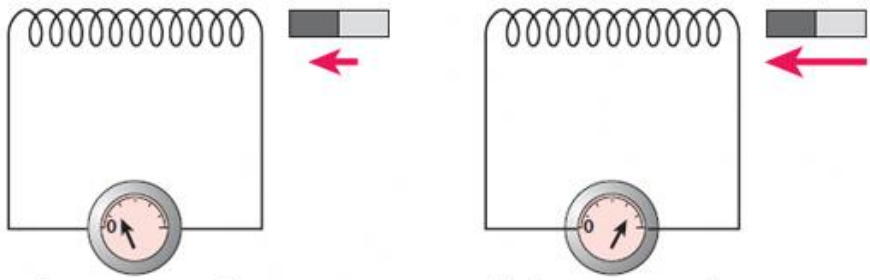
Unlike propulsion coils, surfacing and guiding coils do not require electricity to be run from a substation. Due to the phenomenon of (1) _____, the current flows naturally and the coil becomes a magnet.

This phenomenon means that when a magnet is brought close to a coil, an electric current flows through the coil. A magnetic field is generated in the coil through which the current flows, so the coil not connected to the power supply becomes (2) _____.

(a) Electromagnetic induction **(b) Electrostatic induction**
(c) Temporarily electromagnet **(d)Permanently electromagnet**

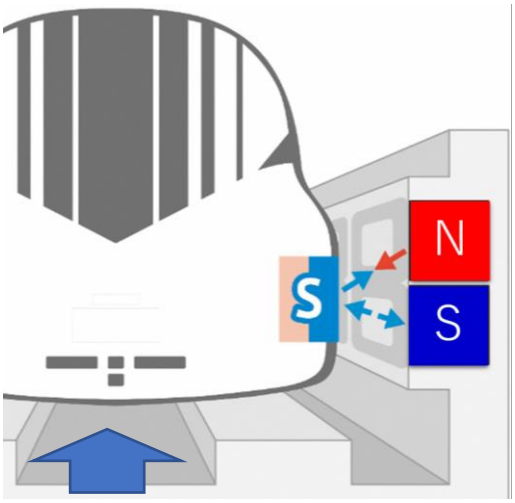
Mechanism of SCMAGLEV levitation

The strength of a magnetic field emitted by a coil is determined by how fast a magnet of the same strength is moving. The higher the speed, the stronger the magnetic field and the greater the magnetic force generated.



In the case of superconducting Maglev trains, the superconducting magnets in the vehicle body act on the levitation and guidance coils in the guideway. The strength of the magnetic force acting between the superconducting magnet and the levitation and guidance coil increases in proportion to the speed at which the superconducting magnet moves (i.e. the speed at which the vehicle body moves), so the (3) , the stronger the magnetic force generated by the levitation and guideway coil and the (4) .

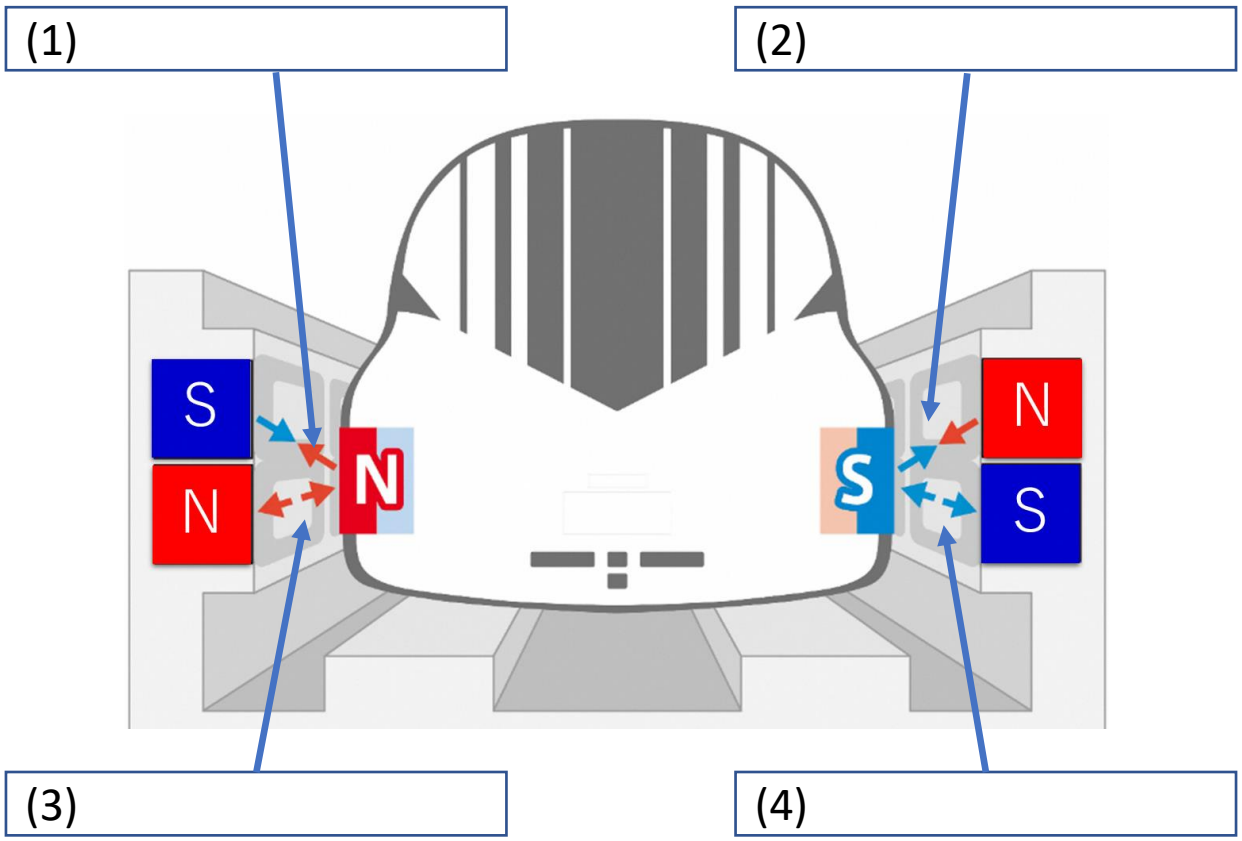
(a) Faster the vehicle body moves (b) Slower the vehicle body moves
(c) Higher the vehicle body lifts (d) Lower the vehicle body sinks



levitated

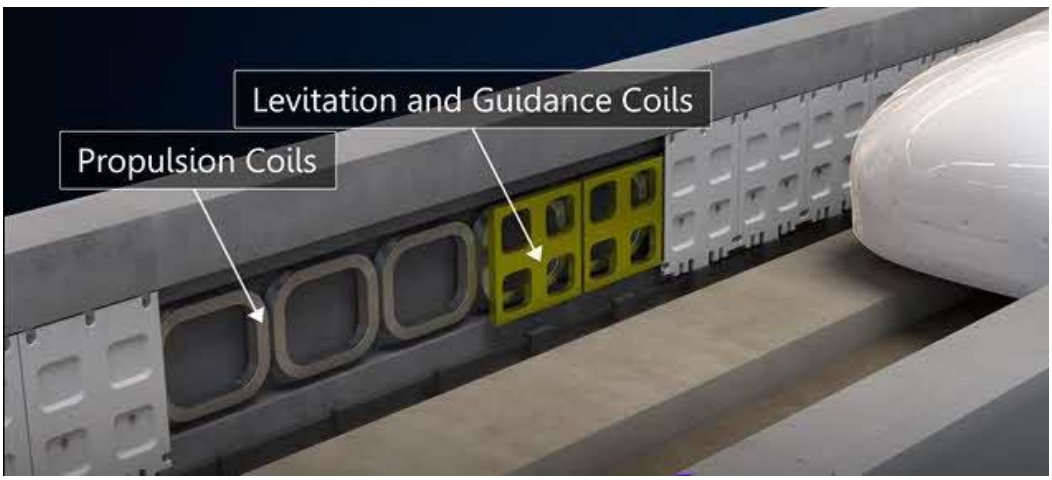
Mechanism of SCMAGLEV levitated

10 To complete each item, choose the best word from among the two choices.



(a) Attractive (b) Repulsive

Propelling with the “Propulsion Coils” and
levitating with the “Levitation and Guidance Coils”

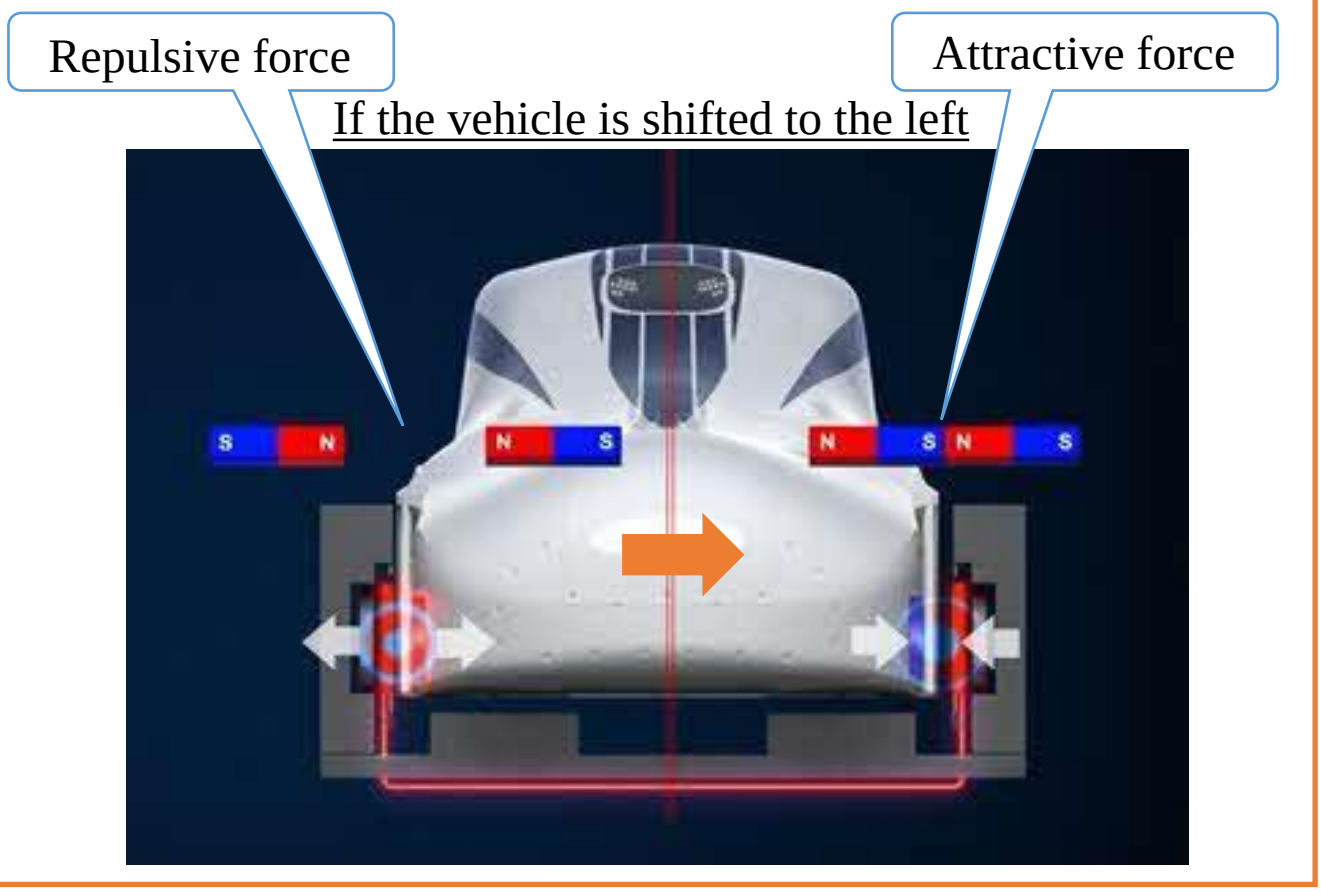


Mechanism for preventing collision

11 To complete each item, choose the best word from among the two choices.

Vehicle travels at the centre of the guideway.
Even when the vehicle leans closer to one side, the magnetic force that acts between superconducting magnets and the Levitation and Guidance Coils keep the train (1) in the guideway at all times.
The magnetic force prevents the Superconducting Maglev from crashing into guideway walls and contributes to stable operation.

(a) Centred **(b) Edged**



12 The history of SCMAGLEV development in Japan.

1962

1972

1979

1980

1997

2002

2009

2013

2020

Types of MAGLEV

13

There are two types of MAGLEVs: 'superconductive' and 'normal-conducting'; SCMAGLEV uses the 'superconductive' method, which levitates 10 cm for safety in Japan, where earthquakes are common.

SCMAGLEV

Levitation height:
10cm
Maximum speed:
500km/h(311mph)

Birmingham People Mover

Levitation height:
1.5cm
Maximum speed:
36 km/h (22 mph)

HSST

Levitation height:
0.8cm
Maximum speed:
100km/h(62mph)

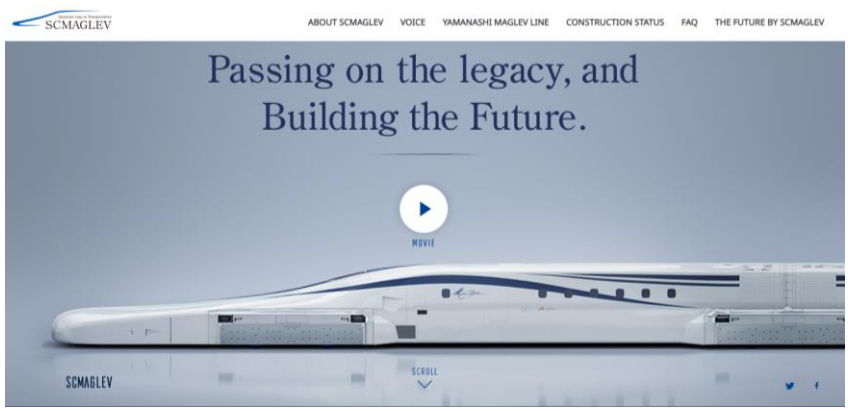
Transrapid in Shanghai

Levitation height:
1cm
Maximum speed:
430km/h(267mph)

Look back at today's class

14 Write down your thoughts about today's class

Scan the QR code to learn more about SCMAGLEV.



https://scmaglev.jr-central-global.com/

Answer

question		answer
2	1	a
3	1	a
	2	i
	3	c
	4	e
	5	g
4	1	a
	2	c
	3	e
5	1	b
	2	c
	3	f
	4	e
	5	h

question		answer
6	1	a
7	1	b
8	1	b
9	1	a
	2	c
	3	a
	4	c
10	1	a
	2	a
	3	b
	4	b
11	1	a