



THE SCIENCE  
ACADEMY

# SECONDARY 1 SCIENCE E-TRIAL

---

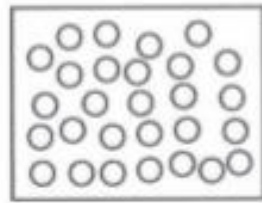
S1 SCIENCE

THE SCIENCE ACADEMY

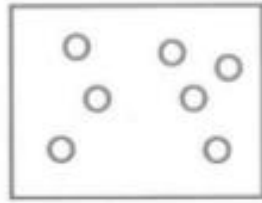


# Particulate Nature of Matter - 1

The diagram shows the arrangement of molecules of a substance **X** at different temperatures.



at 75 °C



at 120 °C

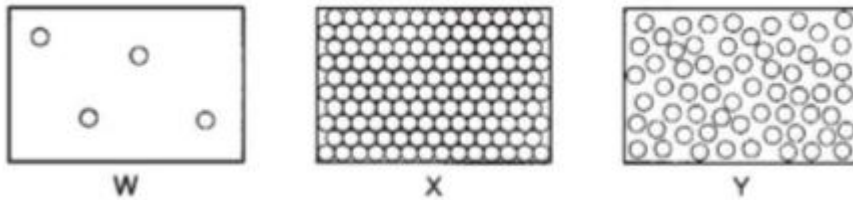
Which of the following shows the melting and boiling points of substance **X**?

	Melting point/ °C	Boiling point/ °C
A	-130	-76
B	30	130
C	70	150
D	70	100

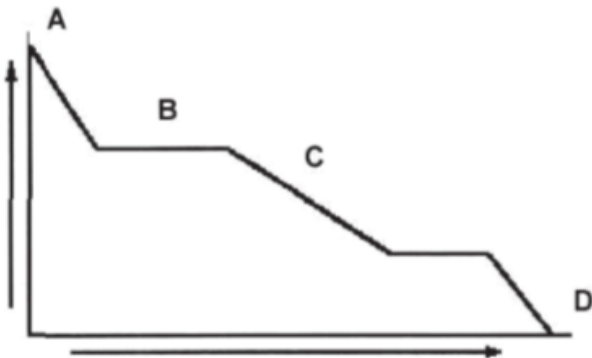


# Particulate Nature of Matter - 2

Diagrams **W**, **X** and **Y** show how the particles of a substance are arranged at different temperatures.



Diagrams **W**, **X** and **Y** show how the particles of a substance are arranged at different temperatures.





# Particulate Nature of Matter - 3

The table below shows the melting and boiling points of four pure substances. Which substance will undergo a change in physical state when heated from 30°C to 50°C?

	Melting point/ °C	Boiling point/ °C
A	-9	24
B	-20	89
C	45	108
D	367	951



# Particulate Nature of Matter - 4

Which of the following is true when steam condenses to water?

	Kinetic energy	Potential energy
A	increases	Remain the same
B	decreases	increases
C	increases	decreases
D	Remain the same	decreases



# Particulate Nature of Matter - 5

---

Gas particles at room temperature are able to move at very high speeds. However, when a bottle of perfume is opened at the end of a large room, it might take several minutes before its smell can be detected at the other end.

Which of the following explains this phenomenon?

A	Perfume particles move slower than the gas particles in the air.
B	Random collisions occur among the perfume particles.
C	Random collisions occur between perfume particles and gas particles.
D	Strong attractive forces exist between perfume particles and gas particles.



# Particulate Nature of Matter - 6

The table below shows the melting points and boiling points of five different substances P, Q, R, and S.

Substance	Melting point / °C	Boiling point / °C
P	95	280
Q	24	74
R	-26	37
S	31	140



# Particulate Nature of Matter - 6

---

Which substance(s) would be a solid at 22 °C but is a liquid at 100 °C?

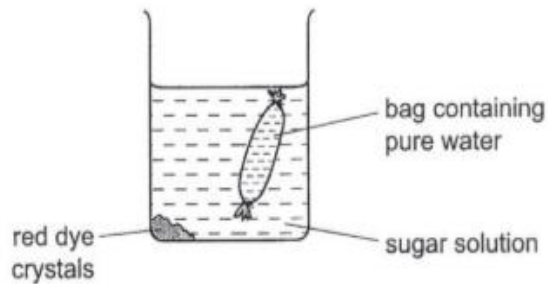
- A. P only
- B. P and Q
- C. P and S
- D. P, Q and R





# Particulate Nature of Matter - 7

An experiment was set-up, as shown in the diagram below, to investigate the movement of substances.



After 24 hours, the red dye is equally spread throughout the sugar solution and the contents of the bag. The volume inside the bag has also changed.



# Particulate Nature of Matter - 7

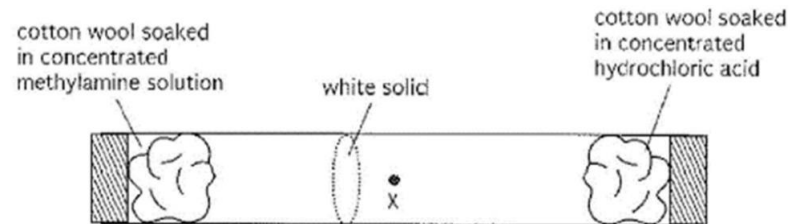
Which of the following is correct?

	The red dye has moved by	The volume inside the bag has	The wall of the bag is
A	Diffusion	Decreased	Partially permeable
B	Diffusion	Increases	Not permeable
C	Osmosis	Increased	Not permeable
D	Osmosis	Increased	Not permeable



# Particulate Nature of Matter - 8

Methylamine and hydrogen chloride are both gases which are soluble in water. The gases react together to form a white solid, methylammonium chloride. In an experiment to demonstrate the diffusion of substances, the following apparatus is set up. X is the midpoint between the two cotton wools.





# Particulate Nature of Matter - 8

---

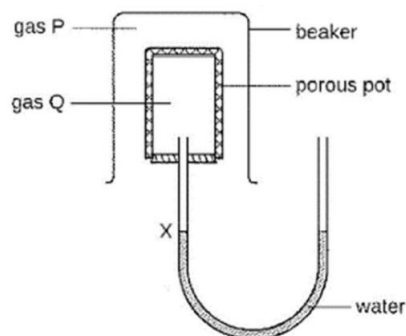
Which of the following inferences can be made from the observation?

- A. Methylamine has greater molecular mass
- B. Hydrochloric acid has a greater molecular mass
- C. There are more gaseous molecules of methylamine
- D. There are more gaseous molecules of hydrochloric acid



# Particulate Nature of Matter - 9

The apparatus below is used to show the diffusion of gases.



Which pair of gases P and Q would cause the water level at X to decrease?

	<u>Gas P</u>	<u>Gas Q</u>
A	Ethane, $C_2H_6$	Nitrogen, $N_2$
B	Carbon Dioxide, $CO_2$	Propane, $C_3H_8$
C	Hydrogen Chloride, $HCl$	Ammonia, $NH_3$
D	Sulfur Dioxide, $SO_2$	Chlorine, $Cl_2$



# Particulate Nature of Matter - 10

---

When steam condenses to water at room temperature, the water molecules

- A. Become regularly arranged
- B. Become smaller
- C. Lose energy
- D. Move further apart



# Particulate Nature of Matter - 11

Use the data given in the table below to answer the questions that follow:

element	melting point / °C	boiling point / °C
<b>A</b>	-106	-39
<b>B</b>	-28	0
<b>C</b>	-3	37
<b>D</b>	101	222
<b>E</b>	589	1201

a) Which substance are solids at room temperature?

b) Carbon tetrachloride ( $\text{CCl}_4$ ) exists as a volatile liquid at room temperature. Which substance is likely to be carbon tetrachloride? Explain your answer.



THE SCIENCE  
ACADEMY

# Particulate Nature of Matter - 11

---

c) In the box below, draw and describe the arrangement of the particles for element A at  $-107^{\circ}\text{C}$ .



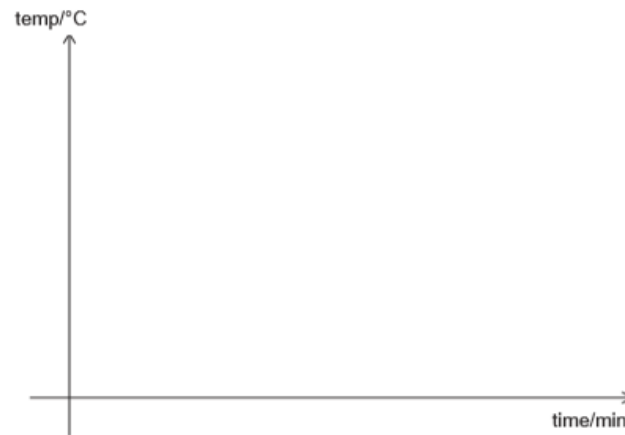




# Particulate Nature of Matter - 11

---

d) Using the axis provided, sketch the heating curve for a pure sample of element **E** when it is heated from  $500^{\circ}\text{C}$  to  $1300^{\circ}\text{C}$ . Indicate the temperature at which changes occur clearly in the graph.



e) Describe the changes in arrangement of the particles in element **E** when the temperature increases from  $1200^{\circ}\text{C}$  to  $1300^{\circ}\text{C}$ .



# Particulate Nature of Matter - 12

---

a) State the kinetic particle theory of matter.

b) In the space below, draw a diagram to show the arrangement of particles in a solid.





# Particulate Nature of Matter - 12

---

c) By referring to the particles in matter, explain

(i) Why the density of a gas is very low;

(ii) Why liquid takes the shape of the container it is in.



# Particulate Nature of Matter - 13

---

Dry ice is carbon dioxide in the solid state. A piece of dry ice was placed on the table at room temperature and white fumes (gases) were seen coming from the dry ice.

a) In the box provided, draw the arrangement of particles in dry ice and in the white fumes.

dry ice	white fumes



# Particulate Nature of Matter - 13

---

b) In the given choices, circle the process that the dry ice underwent at room temperature.

<i>melting</i>	<i>boiling</i>	<i>freezing</i>	<i>sublimation</i>	<i>heating</i>
----------------	----------------	-----------------	--------------------	----------------

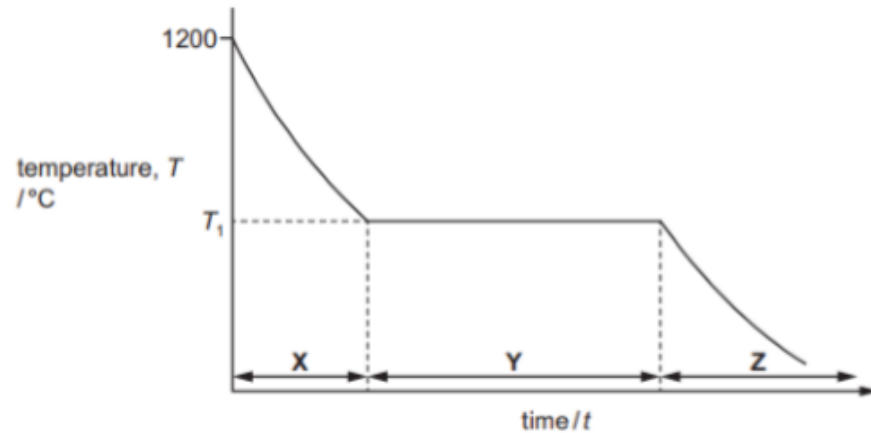
c) Using Kinetic Particle Theory, explain the process identified in (b).



# Particulate Nature of Matter - 14

The graph represents how the temperature of a sample of copper (melting point  $1085^{\circ}\text{C}$ ) changes as it is gradually cooled from  $1200^{\circ}\text{C}$ .

Identify the state(s) of matter present during each stage of the process shown in the graph.



- X.....
- Y.....
- Z.....

Describe and explain the changes in the movement and arrangement of the particles in copper during stage **X**.



# Particulate Nature of Matter - 15

a) Define the term diffusion.

b) The experiment is set up as below to investigate the rate of diffusion of different gases.



The time taken for the 50 cm<sup>3</sup> of various gases to escape from the syringe is recorded below:

Gas	Time taken / s
N <sub>2</sub>	?
C <sub>3</sub> H <sub>8</sub>	120
CO	65
CH <sub>4</sub>	40
NH <sub>3</sub>	45

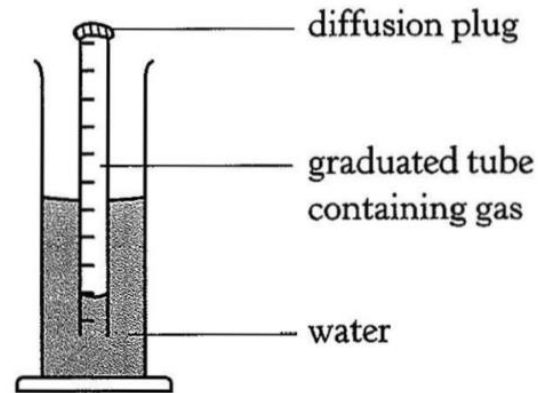






# Particulate Nature of Matter - 15

iv) The experiment set up is changed by replacing the syringe with a graduated tube with a lower end enclosed by water.

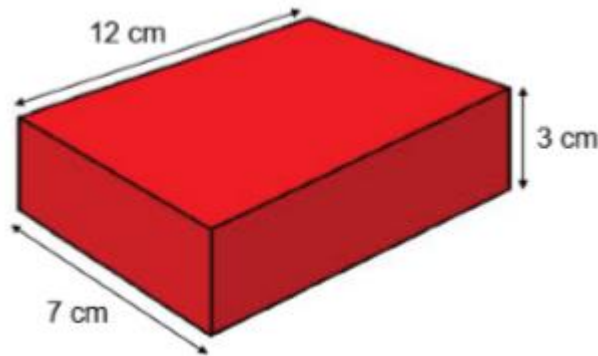


Which of the gases in the table will not be suitable to determine its rate of diffusion using this set up? Explain your answer.



# Forces and pressure - 1

The diagram below shows a cuboid of dimensions 12 x 7 x 3 cm. The mass of the cuboid is 400 g. (gravitational field strength = 10 N/kg). What is the greatest pressure that can be exerted by the cuboid on a surface?

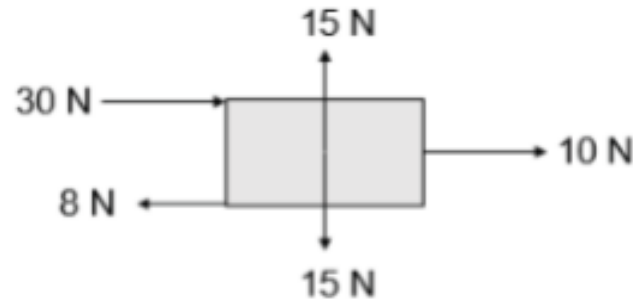


- A.  $0.11 \text{ N/cm}^2$
- B.  $0.19 \text{ N/cm}^2$
- C.  $11 \text{ N/cm}^2$
- D.  $19 \text{ N/cm}^2$



# Forces and pressure - 2

The diagram below shows some forces acting on a stationary box.



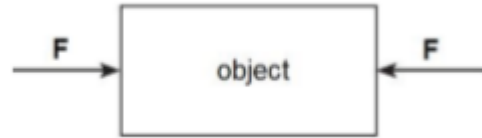
What is the magnitude of the resultant force acting on the box, and in which direction will the box move?

- A. 32N, move to the left
- B. 32N, move to the right
- C. 28N, move to the right
- D. 28N, move to the right



# Forces and Pressure - 3

Which of the following is/are possible when an object, as shown below, experiences two equal and opposite forces?



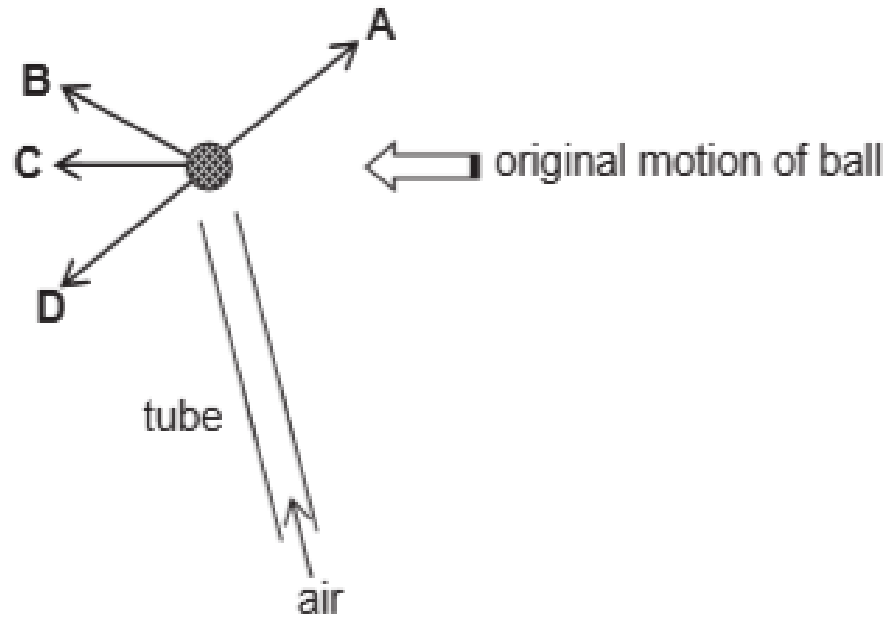
- I. If the object is at rest, it will continue to remain stationary.
- II. If the object is moving, it will accelerate.
- III. If the object is moving, it will continue to move at constant velocity.

- A. I only
- B. I and II only
- C. I and III only
- D. I, II and III



# Forces and Pressure - 4

A lightweight ball moves across a table and passes the end of a tube through which air is blown. In which direction will the ball now move?





# Forces and Pressure - 5

---

A cheetah runs very quickly to catch its prey. The air resistance experienced by the cheetah and the friction between the cheetah and the ground vary with the conditions. Which one of the following conditions below will the cheetah reach its maximum speed?

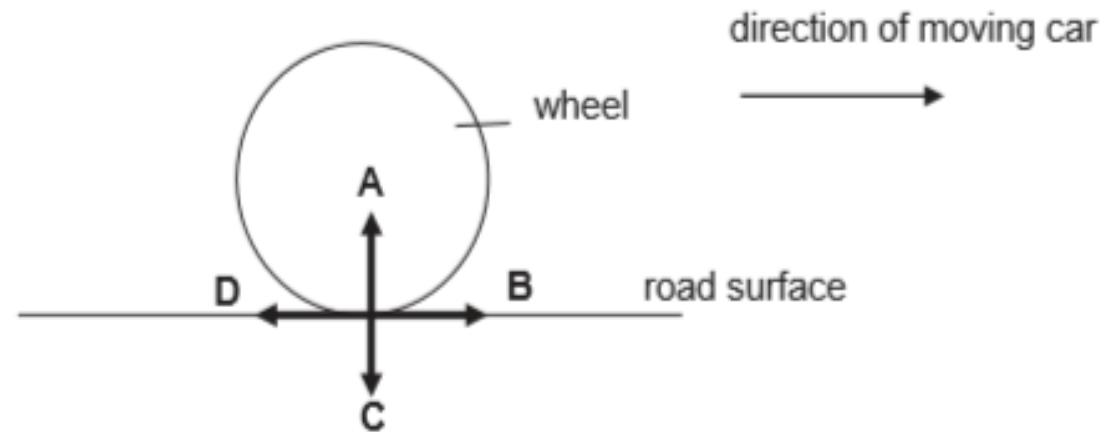
	Air resistance	Friction with ground
A	High	Low
B	High	High
C	Low	Low
D	Low	High



# Forces and Pressure - 6

The diagram shows the wheel of a car which is moving in the direction shown.

In which direction does the frictional force between the wheel and the road surface act?





# Forces and Pressure - 7

Two instruments are used on Earth to measure the weight and mass of an object. A spring balance reads 6 N and a beam balance requires 6 pieces of 100 g discs to balance. The measurements are then repeated on the Moon, where the gravitational field strength is 6 times less than on Earth.

Which correctly shows the results expected?

	Reading on spring balance/N	Number of 100g discs required to balance
A	1	1
B	1	6
C	6	1
D	6	6





# Forces and Pressure - 8

---

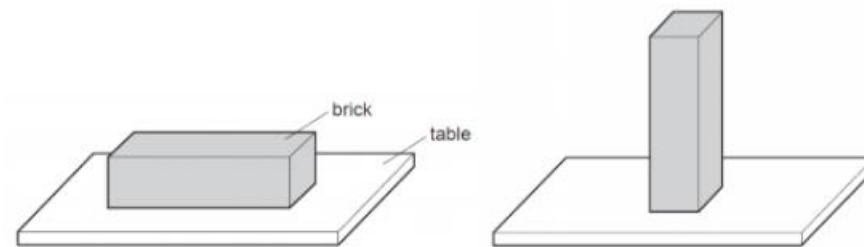
Which statements about friction is true?

- A. It causes energy conversion to heat.
- B. A stationary object is free from friction
- C. It only happens when an object moves
- D. It always acts in the same direction as the motion of the object



# Forces and Pressure - 9

A brick with flat rectangular sides rests on a table. The brick is then turned so that it rests on the table on its smallest surface.



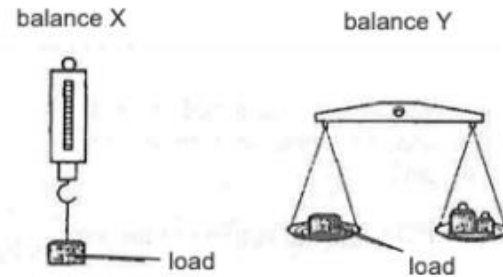
Which row correctly shows how the force and pressure exerted by the brick on the table changed?

	Force	Pressure
A	increased	increased
B	increased	unchanged
C	unchanged	Increased
D	unchanged	unchanged



# Forces and Pressure - 10

A load is placed on balance X and then on balance Y.



	Balance X	Balance Y
A	mass	mass
B	mass	weight
C	weight	mass
D	weight	weight



# Forces and Pressure - 11

---

A laboratory is testing the robotic arms of a Lunar Rover. The arms needs to be able to lift 100 g of rock samples on the Moon. The gravitational field strength at the surface of the Moon is 1.6 N/kg.

a) Explain what is meant by the gravitational field strength at the surface of the Moon is 1.6 N/kg”.

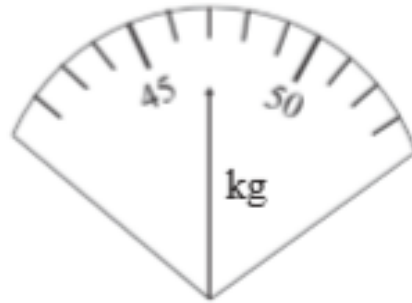
b) Calculate the force needed to lift a 100 g rock on the Moon.

c) The test shows that the robotic arm can lift up to 50 g rock on the Earth. Explain if this arm is suitable for the rover. The gravitational field strength on Earth is 10 N/kg.



# Forces and Pressure - 12

Barbara's mass reading on Earth is shown below. Take gravitational field strength to be 10 N/kg.



- a) Find Barbara's weight on Earth
- b) Barbara now stands on Planet X. Her weight on planet X is 212 N.
  - (i) Write down Barbara's mass on Planet X
  - (ii) Determine the gravitational field strength of Planet X.



THE SCIENCE  
ACADEMY

# Forces and Pressure - 12

---

c) Each of Barbara's foot has a surface area of  $0.010 \text{ m}^2$ . Calculate the pressure exerted by Barbara's feet on the weighing scale on Earth.



# Forces and Pressure - 13

---

A soccer ball is placed on a flat, sandy ground as shown in Fig. 1.



Fig. 1

Draw the force(s) acting on the soccer ball in the figure below. Label your forces clearly.



# Forces and Pressure - 13

---

A student kicks the ball. Draw and label clearly, in the figure below, all the forces acting on the ball at the moment of contact between the student's foot and the ball.







# Forces and Pressure - 13

---

The ball flies through the air after being kicked by the student. Draw and label clearly, in the figure below, all the force(s) acting on the ball as it is moving through the air. Air resistance is not negligible.

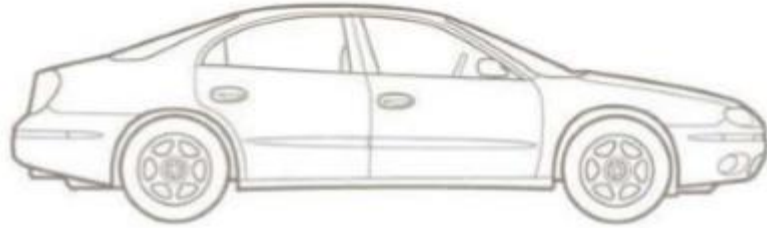




# Forces and Pressure - 14

---

The diagram shows the exterior design of a sedan car.



- Explain how the exterior design of the car helps to reduce friction when it is moving.
- State the advantage of having markings on the cars' tyres which have many designs and patterns as shown.





# Forces and Pressure - 14

---

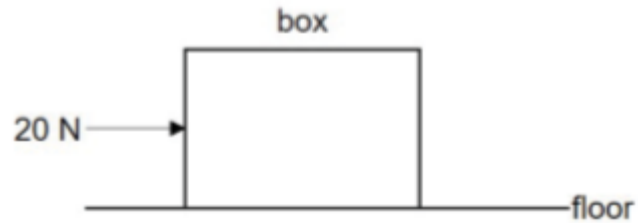
c) An architect is tasked to design a car park on the top floor of a building that can accommodate as many cars as possible. The building's top floor is rectangular in shape with the dimension, 0.068 km by 0.04 km. If the construction material can withstand a pressure of 520 Pa, calculate the maximum number of cars that this car park can accommodate, assuming that a normal car has a maximum mass of 2000 kg.



# Forces and Pressure - 15

---

The diagram shows a box pushed by a force of 20 N along the floor.



- a) On the diagram, indicate using arrows and label clearly
- (i) the weight of the box and
  - (ii) the direction of the frictional force acting on the box.



# Forces and Pressure - 15

---

c) Name an apparatus that can measure the weight of the box.

d) A lady put on an old pair of sandals to go to the wet market as she did not want to dirty her new ones. While she was walking around in the wet market, she slipped and fell.

(i) Based on your understanding of forces, suggest a reason why the lady slipped and fell.

(ii) Suggest a reason why she would not have easily slipped had she worn the new sandals.