1. Motion, forces and energy

1.3 Mass and weight

Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 Which quantity is equal to gravitational force?

A gravitational field strength × mass

B gravitational field strength × weight

C mass per unit weight

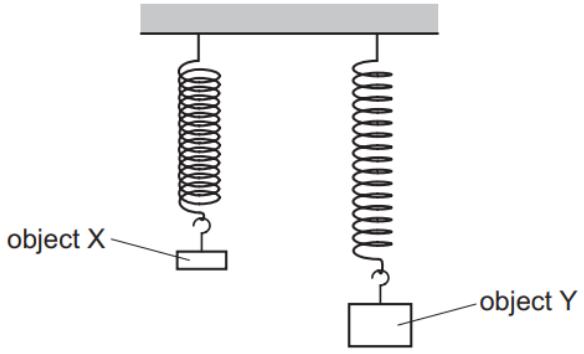
D weight per unit mass

2 Which row contains two correct statements about the mass and the weight of an object?

	mass of an object	weight of an object
A	is measured using a measuring cylinder	is measured using a balance
B	is the gravitational force exerted on the object	is the quantity of matter in the object
C	is measured in newtons	is measured in kilograms
D	is the same everywhere	can vary from place to place

3 The diagram shows two objects, X and Y, suspended from identical springs.

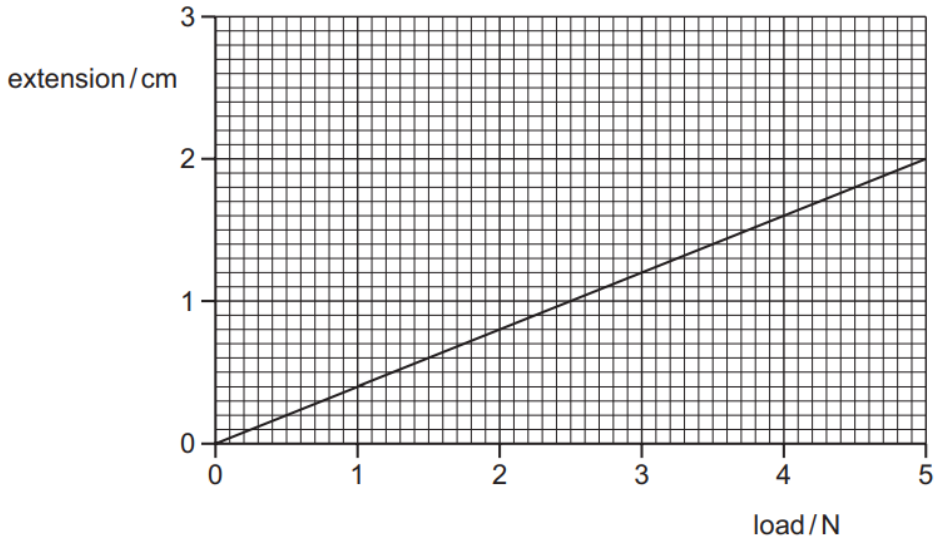
The extension of each spring is different.



Which row compares the mass and the weight of the two objects?

	mass	weight
A	both objects have the same mass	both objects have the same weight
B	both objects have the same mass	the weight of X is less than the weight of Y
C	the mass of X is less than the mass of Y	both objects have the same weight
D	the mass of X is less than the mass of Y	the weight of X is less than the weight of Y

4 The extension–load graph for a spring is shown. The unstretched length of the spring is 15.0 cm.



When an object of unknown weight is suspended on the spring, the length of the spring is 16.4 cm.

What is the weight of the object?

A 0.55 N **B** 0.67 N **C** 3.5 N **D** 4.1 N

5 Which statement about the weight of an object is correct?

A The weight of an object is the gravitational force per unit mass.

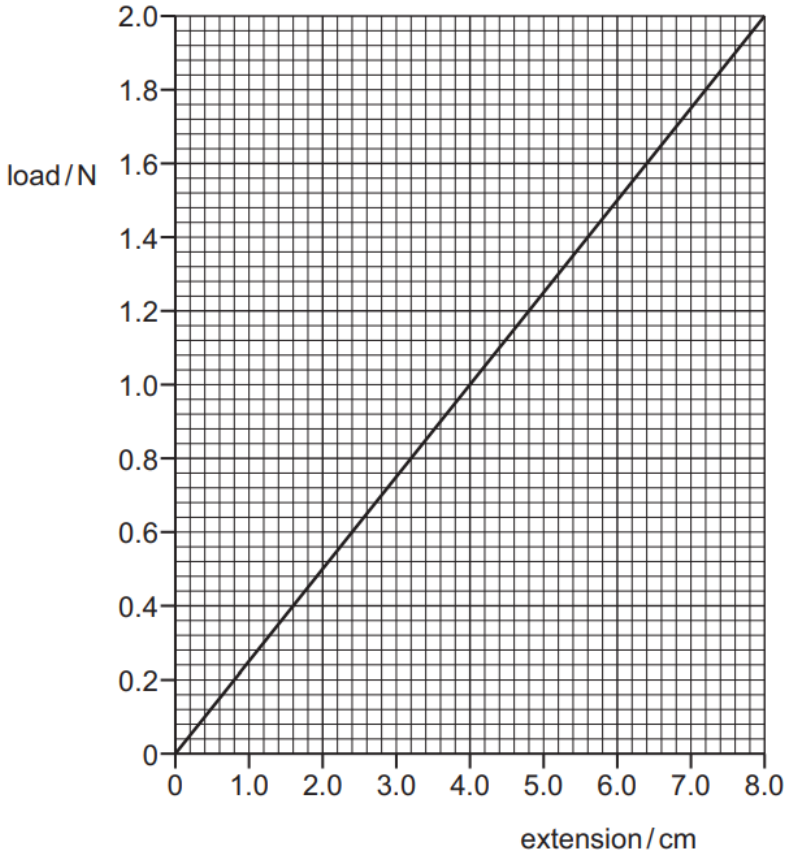
B The weight of an object is the gravitational force on an object.

C The weight is zero when the object is falling at constant speed in the Earth's atmosphere.

D The weight is zero when the object is in orbit around the Earth.

6 The diagram shows a load–extension graph for a steel spring.

The length of the spring with no load attached is 2.0 cm.



Which load increases the length of the spring to 6.0 cm?

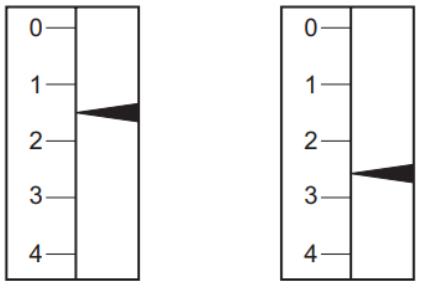
A 0.5 N **B** 1.0 N **C** 1.5 N **D** 2.0 N

7 An object weighs 19 N on a planet where the acceleration of free fall is 3.8 m/s^2.

What is the mass of the object?

A 0.20 kg **B** 1.9 kg **C** 5.0 kg **D** 72 kg

8 An object is suspended from a spring balance on the Earth. The same object is suspended from the same spring balance on another planet.



Which statement explains the difference between the two readings?

A Both the mass and the weight of the object are greater on the other planet.

B The mass of the object is greater on the other planet than on the Earth, but the weight is unchanged.

C The spring stretches more easily when on the other planet.

D The weight of the object is greater on the other planet than on the Earth, but the mass is unchanged.

9 A person steps onto a bathroom scale.

The bathroom scale records both mass and weight.

Which row shows the readings on the bathroom scale?

	mass	weight
A	60 N	590 kg
B	60 kg	590 N
C	590 kg	60 N
D	590 N	60 kg

10 Which unit is a unit of weight?

A kilogram

B kilojoule

C kilometre

D kilonewton

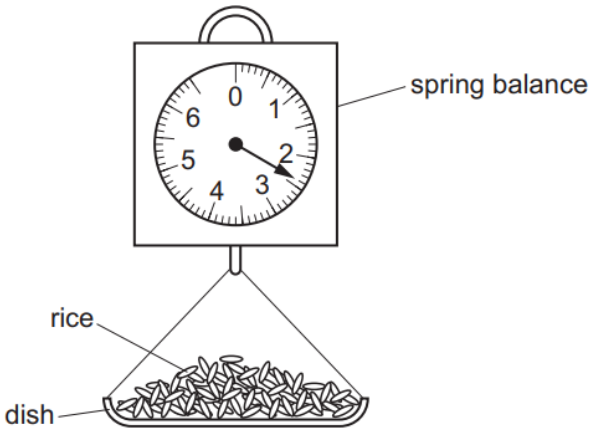
11 A space rocket travels to the Moon.

The acceleration of free fall is greater on the Earth than it is on the Moon.

How do the mass and weight of the space rocket on the Moon compare with their values on the Earth?

	mass on the Moon	weight on the Moon
A	less than on the Earth	same as on the Earth
B	less than on the Earth	more than on the Earth
C	same as on the Earth	less than on the Earth
D	same as on the Earth	more than on the Earth

12 A shopkeeper pours rice into a dish that hangs from a spring balance. He records the reading.



A customer buys some pasta. The shopkeeper notices that the reading on the spring balance, with just pasta in the dish, is the same as it was with just rice in the dish.

Which quantity **must** be the same for the rice and for the pasta?

A density

B temperature

C volume

D weight

13 Which statement about mass or weight is **not** correct?

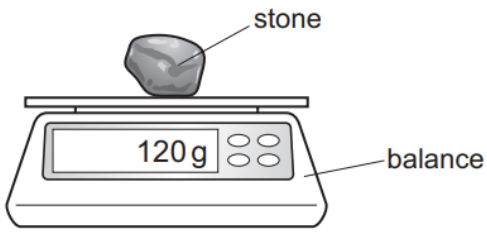
A Masses can be compared using a balance.

B Mass is a force.

C Weights can be compared using a balance.

D Weight is a force.

14 A stone is placed on a balance as shown.



Which row gives the mass and weight of the stone?

	mass	weight
A	120 g	1.2 N
B	120 g	1200 N
C	1.2 N	120 g
D	1200 N	120 g

15 Which row shows the mass and the weight of an object near the Earth's surface?

	mass / kg	weight / N
A	0.2	0.2
B	2	0.2
C	2	20
D	20	10

16 A spring balance operates by the compression of a spring. It has been calibrated on the Earth in grams.

A beam balance operates by balancing standard masses against the unknown mass to be measured.

The same unknown mass is measured with each balance on the Earth and on the Moon.

The gravitational field strength on the Earth is greater than that on the Moon.

How would the measurements on the Earth compare with those on the Moon?

	spring balance measurements	beam balance measurements
A	larger on the Earth than on the Moon	larger on the Earth than on the Moon
B	larger on the Earth than on the Moon	same on the Earth as on the Moon
C	same on the Earth as on the Moon	larger on the Earth than on the Moon
D	same on the Earth as on the Moon	same on the Earth as on the Moon

17 An object is moved from point X to point Y.

The acceleration of free fall at X is different from that at Y.

Which statement about the object at Y is correct?

A Both its mass and its weight are different from those at X.

B Both its mass and its weight are the same as those at X.

C Its mass is the same as at X but its weight is different.

D Its weight is the same as at X but its mass is different.

18 The gravitational field strength on the Moon is smaller than that on the Earth.

A scientist examines a rock which has been brought back from the Moon.

He measures three quantities.

1 the density of the rock

2 the mass of the rock

3 the weight of the rock

Which quantities are the same size on the surface of the Earth and on the surface of the Moon?

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

19 Which statement about the equation shown is correct?

$$W = mg$$

A g is a force, m and W are not forces.

B m is a force, g and W are not forces.

C W is a force, g and m are not forces.

D None of g, m and W are forces.

20 Diagram 1 shows a sealed plastic bottle containing a hollow glass sphere and a steel ball.

Diagram 2 shows the same bottle after it has been shaken.

Diagram 3 shows the same bottle after it has been shaken again until the broken glass is in tiny pieces.

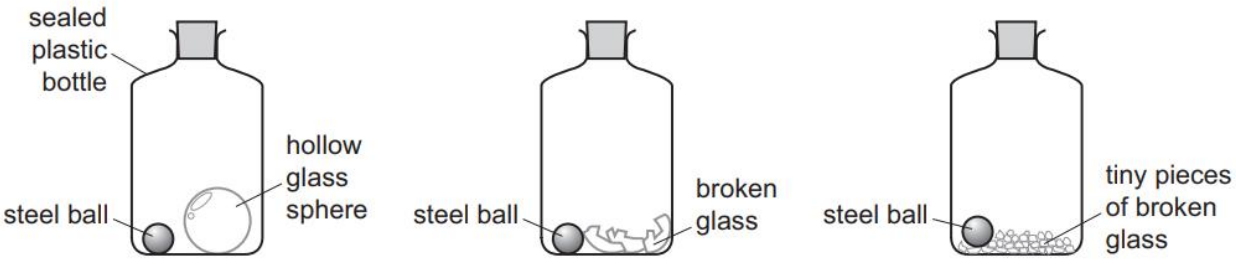


diagram 1 diagram 2 diagram 3

The mass of the bottle and contents in diagram 1 is m_1.

The mass of the bottle and contents in diagram 2 is m_2.

The mass of the bottle and contents in diagram 3 is m_3.

Which statement gives the correct relation between m_1, m_2 and m_3?

A m_1 is equal to m_2 and m_2 is equal to m_3.

B m_1 is greater than m_2 and m_2 is greater than m_3.

C m_1 is less than m_2 and m_2 is greater than m_3.

D m_1 is less than m_2 and m_2 is less than m_3.

21 On Mars, the acceleration of free fall g is $3.7\,\text{m/s}^2$.

What is the weight of a 2.0 kg mass on Mars?

A 0.54 N **B** 1.9 N **C** 7.4 N **D** 20 N

22 An astronaut wants to know how much she would weigh on different moons.

She measures her mass on Earth to be 82 kg. She researches the values of g on different moons and uses these values to calculate her weight.

The results are shown.

Which weight is calculated correctly?

	name of moon	$\frac{g}{\text{N/kg}}$	calculated weight / N
A	Callisto	1.2	68
B	Charon	0.28	23
C	Dione	0.23	2.3
D	Umbriel	0.23	0.0028

23 A student compares the weights of different objects.

Which apparatus does he use?

A balance

B measuring cylinder

C stop-watch

D thermometer

24 Which quantity is weight an example of?

A acceleration

B force

C mass

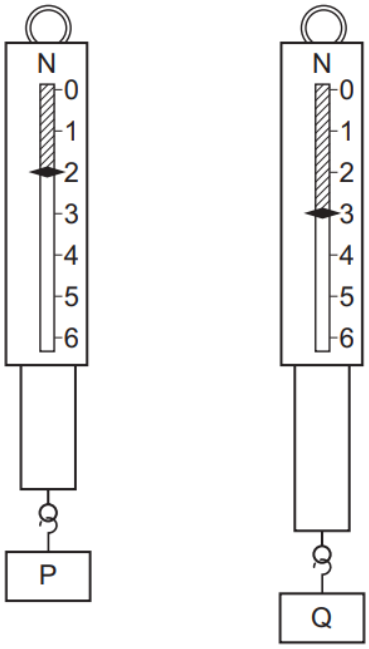
D pressure

25 A stone has a weight of 4.1 N.

What is the mass of the stone?

A 0.41 kg **B** 2.4 kg **C** 4.1 kg **D** 41 kg

26 Two metal blocks P and Q have identical dimensions. They hang on identical spring balances.



Which statement about P and Q is correct?

A They have different volumes and different weights.

B They have different volumes and equal weights.

C They have equal volumes and equal weights.

D They have equal volumes and different weights.

27 A mass of 6.0 kg rests on the surface of a planet.

On this planet, g = 20 N / kg.

What is the weight of the object?

A 0.30 N **B** 0.60 N **C** 60 N **D** 120 N

28 A space probe is taken from the Earth to Mars.

The force of gravity on the surface of Mars is less than the force of gravity on the surface of the Earth.

How do the weight and the mass of a space probe on the surface of Mars compare to their values when the probe is on the surface of the Earth?

	weight on Mars	mass on Mars
A	decreased	decreased
B	decreased	unchanged
C	unchanged	decreased
D	unchanged	unchanged

29 Which quantity is a force due to a gravitational field?

A density

B mass

C weight

D volume

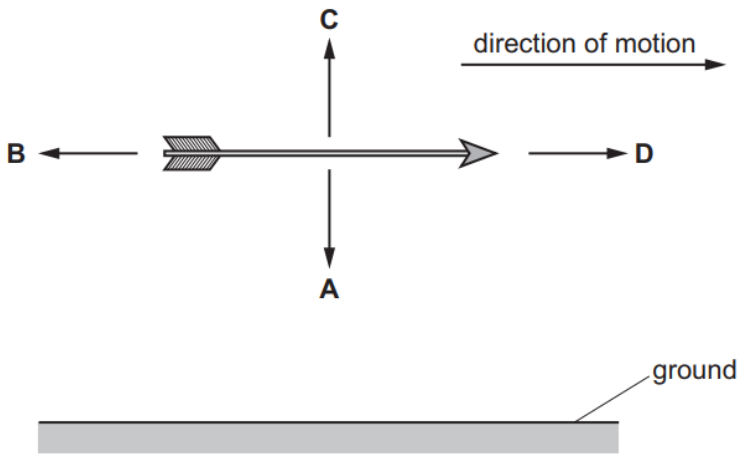
30 A box is placed on the ground. An upward force of 15 N is needed to lift the box at constant speed.

Which row correctly describes the box?

	mass of the box	weight of the box
A	1.5 kg	15 N
B	15 N	1.5 kg
C	15 N	150 kg
D	150 kg	15 N

31 An arrow travels horizontally in a straight line at constant speed.

In which direction does the weight act?



32 Two rectangular blocks consist of different materials.

Four different methods are suggested to compare the two masses.

1 Compare the accelerations with which they fall freely.

2 Compare the values of their lengths × breadths × heights.

3 Hang each in turn from the same spring. Compare the extensions.

4 Place one in the right-hand pan of a beam balance and the other in the left-hand pan.

Which methods give a comparison of the two masses?

A 1, 2 and 3 **B** 1 and 2 only **C** 3 and 4 only **D** 4 only

33 Which row contains two correct statements about the mass and the weight of an object?

	mass of an object	weight of an object
A	is measured using a measuring cylinder	is measured using a balance
B	is the gravitational force exerted on the object	is the amount of matter in the object
C	is measured in newtons	is measured in kilograms
D	is the same everywhere	can vary from place to place

34 The table gives approximate values of the acceleration due to gravity and the atmospheric pressure on three planets.

	Earth	Venus	Mars
acceleration due to gravity / m/s^2	10	9	4
atmospheric pressure / kPa	100	9000	1

A body has a mass of 10 kg on Earth.

Which statement about the weight of the body is correct?

A The weight is greatest on Earth.

B The weight is greatest on Mars.

C The weight is greatest on Venus.

D The weight is the same on each planet.

35 Which quantity is measured in newtons?

A energy

B mass

C weight

D work

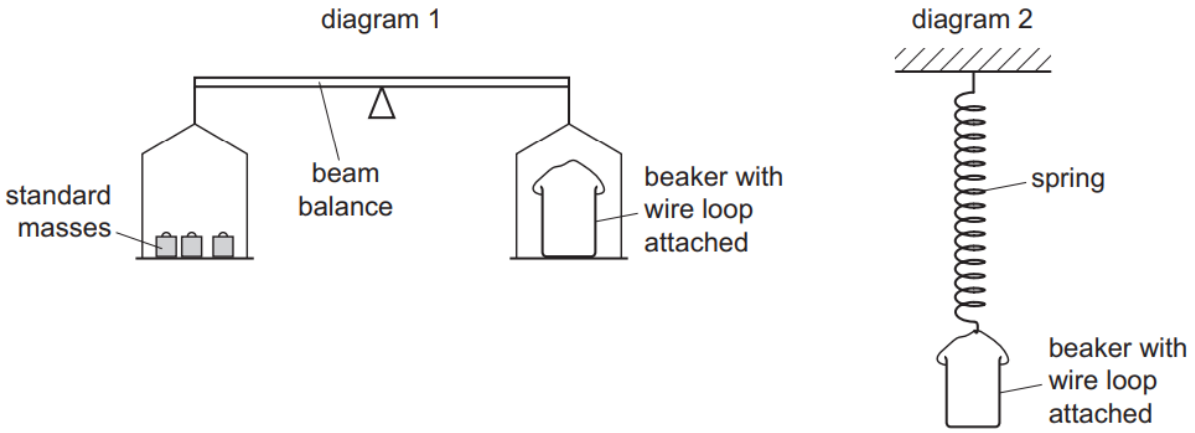
36 Four identical steel blocks are placed on a balance. The reading on the balance is 220 N.

What is the mass of one steel block?

A 5.5 kg **B** 22 kg **C** 55 kg **D** 88 kg

37 Diagram 1 shows a beam balance. A beaker with a wire loop balances the standard masses.

The beaker is then removed and hung from a spring. The spring extends by 5.0 cm, as in diagram 2.



The experiment is repeated with the same apparatus on the Moon, where the acceleration of free fall is less than on Earth.

Which statement describes what happens on the Moon?

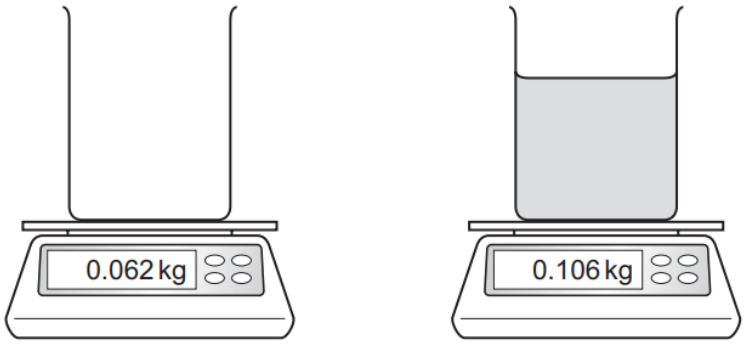
A The beam balance is balanced and the spring extends by 5.0 cm.

B The beam balance is balanced and the spring extends by less than 5.0 cm.

C The right-hand balance pan is higher and the spring extends by 5.0 cm.

D The right-hand balance pan is higher and the spring extends by less than 5.0 cm.

38 An empty beaker is placed on a top-pan balance. Some water is now poured into the beaker.



empty beaker beaker + water

What is the weight of the water?

A 0.044 kg **B** 0.168 kg **C** 0.0044 N **D** 0.44 N

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

39 Which name is given to the quantity of matter in an object?

A density

B mass

C volume

D weight

40 A body is moved from place X to place Y where the gravitational field strength is different.

What happens to its mass and to its weight due to the move?

	mass	weight
A	changes	changes
B	changes	stays the same
C	stays the same	changes
D	stays the same	stays the same

41 An astronaut of mass 80 kg is standing on a planet with gravitational field strength $g = 3.8\,\text{N/kg}$.

What is the weight of the astronaut on this planet?

A 780 N **B** 300 N **C** 210 N **D** 21 N

42 A sphere P, made of steel, has a weight of 10 N on Earth.

Another sphere Q, also made of steel, has a weight of 10 N on Mars.

The gravitational field strength on Earth is greater than the gravitational field strength on Mars.

Which statement is correct?

A The mass of sphere P is the same as the mass of sphere Q.

B The mass of sphere P is less than the mass of sphere Q.

C On Mars, the weight of sphere P is the same as the weight of sphere Q.

D On Earth, the weight of sphere Q is less than 10 N.

43 Which property of an object is a consequence of the effect of a gravitational field acting on it? **(extended only)**

A density

B mass

C volume

D weight

44 Which statement describes the relationship between mass and weight? **(extended only)**

A Mass is the effect of a gravitational field on a weight.

B Mass is the effect of a magnetic field on a weight.

C Weight is the effect of a gravitational field on a mass.

D Weight is the effect of a magnetic field on a mass.

45 On the Moon, all objects fall with the same acceleration.

Which statement explains this?

A On the Moon, all objects have the same weight.

B The Moon has a smaller gravitational field strength than the Earth.

C The weight of an object is directly proportional to its mass.

D The weight of an object is inversely proportional to its mass.

46 An object has a weight of 6.4 N on the Earth where the gravitational field strength is 10 N / kg.

Which row states the mass and the weight of the object on the Moon where the gravitational field strength is 1.6 N / kg?

	mass / kg	weight on the Moon / N
A	0.64	1.0
B	0.64	6.4
C	4.0	1.0
D	4.0	6.4

47 In which situation does object X have a greater mass than object Y? **(extended only)**

A Object X is in a larger gravitational field than object Y and both have the same weight.

B Object X shows a greater resistance to change in motion than object Y and both experience the same resultant force.

C Object X has a lower density than object Y and both occupy the same volume.

D Object X moves at a greater speed than object Y and both possess the same kinetic energy.

48 An object of mass 2.0 kg is taken from the Earth, where the gravitational field strength is 10 N / kg, to the Moon, where the gravitational field strength is 1.6 N / kg.

Which row is correct?

	weight on the Earth / N	weight on the Moon / N
A	0.20	0.80
B	0.20	3.2
C	20	0.80
D	20	3.2

49 What is the best description of the meaning of the 'mass' of an object?

A the space occupied by the object

B the force that gravity exerts on the object

C the resistance of the object to changes in motion

D the closeness of packing of the molecules in the object

50 Which statement about the mass of an object is correct?

A It changes when the object is lifted further from the ground.

B It is the gravitational force on the object.

C It is zero if the object is in orbit around the Earth.

D It resists any change in motion of the object.

51 Four students make statements about the mass of an object.

Which statement is correct?

A The mass of an object depends on the gravitational field which acts on the object.

B The mass of an object divided by its weight is equal to the acceleration with which it falls freely.

C The mass of an object increases when the temperature of the object increases.

D The mass of an object resists change in motion of the object.

52 Which statement about the mass and the weight of an object is correct?

A They are both affected by changes in the acceleration of free fall.

B They are both forces.

C They have different units.

D Weight is calculated by dividing mass by the acceleration of free fall.

53 Which statement about the mass of an object is correct?

A It is equal to the density divided by the volume.

B It is equal to weight multiplied by the gravitational field strength.

C It is the effect of a gravitational field on the object.

D It is the property that resists a change in velocity.