

# Success Key Worksheet

Std: Class 10 (Eng.& Semi)

Ch. 1 Gravitation  
(Worksheet 1)

Time: 1 Hr.

Date:

Subject: Science and Technology -1

Max Marks: 20

**Q.1) Choose the correct alternative and rewrite the statements:**

2

- The SI unit of the universal constant of gravitation is \_\_\_\_\_.  
(a)  $m/s^2$                       (b)  $N.m^2/kg^2$   
(c)  $kg/m.s$                       (d)  $N.kg/m^2$
- Law of gravitation gives the gravitational force between \_\_\_\_\_.  
(a) the earth and sun only  
(b) the earth and a point mass only  
(c) any two bodies having some mass  
(d) two charged bodies only

**Q.2 Answer the following:** (7)

1) Find odd one out:

1

Light, sound, heat, laws of planetary motion

2) Write the correct co-relation:

1

Mass : kg : : Weight : \_\_\_\_.

3) Name the following:

1

Amount of matter present in an object.

4) State True Or False.

2

The SI unit of  $g$  is  $9.8\text{ cm/s}^2$

The SI unit of mass is  $kg$ .

5) Write an explanation.

1

Gravitational force.

6) Match the Columns.

1

Column 'A'	Column 'B'
1.Mass	(a) $m/s^2$
2.Weight	(b) $kg$
3.Acceleration due to gravity	(c) $Nm^2/kg^2$
4.Gravitational constant	(d) $N$
	(e) $mv^2$

**Q.3) Give Scientific reasons. (Any 1)**

2

- A body reach the ground quicker at poles than at the equator when dropped from the same height.
- A person can jump higher on the surface of the moon than on the earth.

**Q.4) Answer the following questions. (Any 2)**

4

- What are  
i) Free ball

ii) acceleration due to gravity

2) Define:

- i) Escape velocity
- ii) Centripetal force.

3) What are the effect of a force acting on an object?

**Q.5) Solve the following questions. (Any 1)**

**2**

- 1) An object takes 5s to reach the ground from a height of 5 cm on a planet. What is the value of  $g$  on the planet?
- 2) The radius of planet A is half the radius of planet B. If the mass of A is  $M_A$ , what must be The mass of B so that the value of  $g$  on B is half that of its value of A?

**Q.6) Answer the following questions in brief. (Any 1)**

**3**

- 1) A stone thrown vertically upwards with initial velocity ' $u$ ' reaches a height ' $h$ ' before coming down. Show that the time taken to go up is same as the time taken to come down.
- 2) State Newton's universal law of gravitation. Express it in mathematical form.

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Worksheet 1(Answer key)

Date:

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**Q.1) Choose the correct alternative and rewrite the statements:**

2

1)Ans. (b)  $N.m^2 / kg^2$

2)Ans. (c) any two bodies having some mass

**Q.2 Answer the following:**

7

1) Find odd one out:

1

Ans. Laws of planetary motion

2) Write the correct co-relation:

1

Ans. Mass : kg : : Weight : N

3) Name the following:

1

Ans. Mass

4) State True Or False.

2

Ans. False

Ans. True

5) Write an explanation.

1

Ans. The force of attraction between all masses in the universe. It is a non contact type of force.

$$F \propto \frac{m_1 m_2}{d^2}$$

6) Match the Columns.

1

Ans. 1) – b), 2) – d), 3) – a), 4) – c)

**Q.3) Give Scientific reasons. (Any 1)**

2

1)Ans. i) The acceleration due to gravity is more at pole than at the equator.

ii) The time taken for a body is less if the acceleration due to gravity is more when the initial velocities and the distance travelled are the same.

Hence, when dropped from the same height a body reaches the ground quicker at poles than at the equator.

2)Ans. i) The earth and the moon have different masses and radii due to which the value of g is different on their surfaces.

ii) The value of acceleration due to gravity (g) on the moon's surface is nearly  $1/6^{\text{th}}$  to that of the surface of earth.

Hence, A person can jump 6 time higher on the moon compared to that on the earth.

**Q.4) Answer the following questions. (Any 2)**

4

1)Ans. Free ball: When the object moves under the influence of the force of gravity alone, it is said to be in a state of free fall.

Acceleration Due to gravity: The acceleration which is gained by an object because of the gravitational force is called its acceleration due to gravity. It is represented by g.

2)Ans. i) Escape velocity: Escape velocity is the minimum speed needed for an object to escape from the gravitational influence of a body.

ii) Centripetal force: It is a force on an object directed to the centre of a circular path that keeps the object on the path.

**3)Ans.** A force acting on an object may cause the object to change shape, to start moving, to stop moving, to accelerate or decelerate. When two object interact with each other they exert a force on each other, the force are equal in size but opposite in direction.

**Q.5) Solve the following questions. (Any 1)**

2

**1)Ans.** Given  $t = 5s$ ,  $S = 5 m$ ,  $u = 0$

Find =  $g$

We have,  $s = ut + \frac{1}{2}at^2$

$$\therefore s = 0 \times 5 + \frac{1}{2}g \times 5^2$$

$$\therefore s = \frac{25}{2}g \quad \therefore g = \frac{10}{25} = 0.4 \text{ m/s}^2$$

The value of  $g$  on the planet is  $0.4 \text{ m/s}^2$ .

**2)Ans.**

$$R_A = R_B / 2 \quad g_B = \frac{1}{2}g_A$$

$M_A$  = mass of planet A

Find :  $M_B$  = mass of planet B

We have the formula giving value of  $g$  on a planet

$$g = \frac{GM}{R^2} \quad \therefore g_A = \frac{GM_A}{R_A^2} \quad \text{and} \quad g_B = \frac{GM_B}{R_B^2}$$

$$\therefore \frac{g_B}{g_A} = \left( \frac{M_B}{M_A} \right) \left( \frac{R_A}{R_B} \right)^2$$

$$\therefore \frac{1}{2} = \left( \frac{M_B}{M_A} \right) \left( \frac{1}{2} \right)^2 = \frac{1}{4} \left( \frac{M_B}{M_A} \right)$$

$$\therefore \frac{M_B}{M_A} = \frac{4}{2} = 2$$

$$\boxed{M_B = 2 M_A}$$

**Q.6) Answer the following questions in brief. (Any 1)**

3

**1)Ans.**

i. Position thrown upwards

initial velocity =  $u$  and height  $h$  before coming down.

Apply kinematic equation of motion

$$v = u + at \quad \therefore t = \frac{v-u}{a} = \frac{0-u}{-g}$$

$$s = ut + \frac{1}{2}at^2$$

$$h = u \left( \frac{u}{g} \right) - \frac{1}{2}g \left( \frac{u}{g} \right)^2$$

$$y = \sqrt{2gh}$$

$$\text{Time } t = \frac{u}{g} = \frac{\sqrt{2gh}}{g}$$

$$t = \sqrt{\frac{2gh}{g}}$$

ii. When stone drop from height h

$$v^2 = u^2 + 2gh$$

$$v = \sqrt{2gh} \quad \dots(i)$$

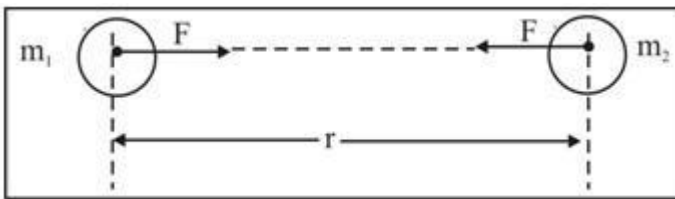
Applying kinematics equation of motion'

$$v = u + at$$

$$t = \frac{v - u}{a} = \frac{\sqrt{2gh} - 0}{g} = \sqrt{\frac{2gh}{g}} \quad \dots(ii)$$

From equation 1 and 2 it is proved that the time taken to go up is same as the time taken to come down.

**2)Ans.** Newton's universal law of gravitation – Every object attracts every other object in the Universe with a force that is directly proportional to the product of the masses and Inversely proportional to the square of the distance between them.



$$\therefore F \propto \frac{m_1 m_2}{r^2}$$

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Ch.1 Gravitation

Time: 1 Hr.

(Worksheet 2)

Date:

Subject: Science and Technology -1

Max Marks: 20

**Q.1) Choose the correct alternative and rewrite the statements:**

2

- The tidal waves in the sea are primarily due to gravitational effect of \_\_\_\_\_.  
(a) sun on the earth      (b) earth on the sea  
(c) earth on the moon      (d) moon on the earth
- According to Newton's first law of motion, higher the mass \_\_\_\_\_ is the inertia.  
(a) zero      (b) lower  
(c) higher      (d) double

**Q.2) Answer the following : 7**

**1) Find odd one out:**

1

Mass, potential energy, radius, weight

**2) Write the correct co-relation:**

1

S.I. unit of weight : newton : : universal constant of gravitation : \_\_\_\_\_.

**3) State whether Right or Wrong.**

1

The moon and the artificial satellites are moving only under the influence of the gravitational field of the earth.

**4) Name the following:**

1

Scientist who was appointed as the royal mathematician in place of Brahe

**5) Answer the following in one sentence.**

1

Who formulated the universal law of gravitation?

**6) State True Or False.**

1

Newton postulated the inverse square law of gravitation.

**7) Match the Columns.**

1

Column 'A'	Column 'B'
1. Escape velocity	(a) $\frac{Gm_1m_2}{r^2}$
2. Gravitational force	(b) $\sqrt{\frac{2Gm}{R}}$
3. Gravitational acceleration	(c) $\frac{-GMm}{(R+h)}$
4. Gravitational potential energy	(d) $\frac{GM}{r^2} (r \geq R)$
	(e) $\frac{-GMm}{2(R+h)}$

**Q.3) Give Scientific reasons. (Any 1)**

2

- The weight of a body is different on different planets.
- The force of gravitation between two cricket balls is extremely small but that between a cricket ball and earth is extremely large.

**Q.4) Answer the following questions. (Any 2)**

4

- What types of forces are you familiar with? What do you know about the gravitational force?
- What would happen if there were no gravity?

3) Why 'G' is called the universal gravitational constant?

**Q.5) Solve the following questions. (Any 1)**

2

- 1) The mass and weight of an object on earth are 5 kg and 49 N respectively. What will be their values on the moon? Assume that the acceleration due to gravity on the moon is  $\frac{1}{6}$ <sup>th</sup> of that on the earth.
- 2) An object thrown vertically upwards reaches a height of 500 m. What was its initial velocity? How long will the object take to come back to the earth? ( $g = 10 \text{ m/s}^2$ )

**Q.6) Solve the following questions. (Any 1)**

3

- 1) A Tennis ball is thrown up and reaches a height of 4.05 m before coming down. What was its initial velocity? How much total time will it take to come down? Assume  $g = 10 \text{ m/s}^2$ .
- 2) The mass of the earth is  $6 \times 10^{24}$  kg. The distance between the earth and the Sun is  $1.5 \times 10^{11}$  m. If the gravitational force between the two is  $3.5 \times 10^{22}$  N, what is the mass of the Sun?  
(Use  $G = 6.7 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$ )

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(Worksheet 2) Answer Key

Date:

Science and Technology -1

Max Marks: 20

**Q.1) Choose the correct alternative and rewrite the statements:**

2

1) Ans. (d) moon on the earth

2) Ans. (c) higher

**Q.2) Answer the following :**

1

1) Find odd one out:

Ans. weight

2) Write the correct co-relation:

Ans. S.I. unit of weight : newton : : universal constant of gravitation :  $N \cdot m^2 / kg^2$

1

3) State whether Right or Wrong.

Ans. Right

1

4) Name the following:

Ans. Johannes Kepler

1

5) Answer the following in one sentence.

Ans. Isaac Newton

1

6) State True Or False.

Ans. True

1

7) Match the Columns.

Ans. 1) – b), 2) – a), 3) – d), 4) – c)

1

**Q.3) Give Scientific reasons. (Any 1)**

2

1) Ans. i) The weight of a body,  $W$  is given as  $W = mg$  where,  $m$  = mass of body and  $g$  = acceleration due to gravity of a plane.

ii) The weight of body is depending on mass and gravity.

iii) The mass of a body remains same everywhere but the value of 'g' changes from each planet.

Hence, the weight of the same body differs on different planets.

2) Ans. i) The force of gravitation between two bodies is directly proportional to the product of their masses

ii) Since the mass of cricket ball is very small as compared to that of the earth, so the force gravitation between two cricket ball is extremely small while that between a ball and the earth is extremely large.

**Q.4) Answer the following questions. (Any 2)**

4

1) Ans. i) Gravitational force

ii) Electrical force

iii) Magnetic force

iv) Frictional force

The Gravitational force is a universal force that not only acts between two objects on earth but also between any two objects in the universe. The gravitational force of attraction is much weaker than other forces in nature but it controls the universe and decides its future.

2) **Ans.** i) Without gravity, everything becomes weight less.

ii) Without gravity, Earth's atmosphere would also disappear means drastic change in air pressure.

iii) Without gravity planets may stop revolving around the sun.

iv) The solar system may collapse in absence of gravity.

3) **Ans.** The constant 'G' is universal because it is independent of the nature and size of bodies, The space where they are kept and at the time at which the force is considered.

**Q.5) Solve the following questions. (Any 1)**

2

1) **Ans.** Given  $m = 5 \text{ kg}$ ,  $W = 49 \text{ N}$

$$g_M = \frac{g_E}{6}, \quad M \text{ (on the moon)} = ?$$

$W \text{ (on the moon)} = ?$

Find = Mass and weight on moon.

Mass in constant quantity.

$\therefore$  Mass on earth = Mass on moon = 5 kg

Now  $W = mg_E$

$$49 = 5 \times g_E \quad \therefore g_E = \frac{49}{5} = 9.8 \text{ m/s}^2$$

Acceleration due to gravity on moon =  $\frac{1}{6} \times g_E$

$$= \frac{1}{6} \times 9.8 = 1.63 \text{ m/s}^2$$

Weight on moon =  $mg = 5 \times 1.63 = 8.16 \text{ N}$

2) **Ans.** Given  $s = h = 500 \text{ m}$ ,  $g = 10 \text{ m/s}^2$ ,  $x = 0 \text{ m/s}^2$

Find : Initial velocity  $u = ?$  total time to come back

As the object moves upward

$$v^2 = u^2 + 2as$$

$$= u^2 + 2(-g)h \quad (\because a = -g)$$

Now,  $v = 0 \text{ m/s}$

$$\therefore u^2 = 2gh = 2 \times 10 \text{ m/s}^2 \times 500 \text{ m}$$

$$u^2 = (100 \times 100) \text{ m/s}^2$$

$$\therefore u^2 = (100 \times 100) \text{ m/s}^2$$

$$\therefore u^2 = 100 \text{ m/s}^2 \text{ (Initial velocity of the body)}$$

Now to find time taken by object to come back to Earth. (Put the value in equation)

$$V = u + at \quad 0 = 100 + (-10 \times t) \quad \therefore t = 10 \text{ second}$$

Time taken by object to move upward = 10s

Time taken by object to move downward 10 s

Total time =  $10 + 10 = 20$  seconds.

It will take 20 s for the object to come back to the earth

**Q.6) Solve the following questions. (Any 1)**

1) **Ans.** Given : Distance travelled by the ball = 4.05 m

$$\text{acceleration } a = 9 = 10 \text{ m/s}^2$$

Find : Initial velocity (u) and time (t) = ?

$$v^2 = u^2 + 2as \quad \dots(i)$$

$$s = ut + \frac{1}{2}at^2 \quad \dots(ii)$$

i) For upward motion of the ball (v) = 0

$$a = -g = -10 \text{ m/s}^2$$

as per formula (i)

$$0 = u^2 + 2(-10) \times 4.05$$

$$\therefore u^2 = 81$$

$$\therefore u = 9 \text{ m/s}$$

ii) For down word motion of the ball (u) = 0

$$a = g = 10 \text{ m/s}^2$$

as per formula (ii)

$$4.05 = 0 + \frac{1}{2} \times 10t^2$$

$$\therefore t^2 = \frac{4.05}{5} = 0.81$$

$$\therefore t = 0.95$$

Time for upward journey of the ball will be the same as time for downward journey i.e. 0.95

$$\therefore \text{Total time taken} = 2 \times 0.9 = 1.85$$

i) The initial velocity of the ball is 9 m/s

ii) The total time taken by the ball to reach the ground is 1.85

2) **Ans.** Force of attraction (F) =  $3.5 \times 10^{22}$  N

distance between the earth and the Sun =  $1.5 \times 10^{11}$  m

Mass of the earth (M) =  $6 \times 10^{24}$  kg

$G = 6.7 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$

Mass of the sun (m)

$$F = \frac{GMm}{R^2}$$

$$m = \frac{FR^2}{GM} = \frac{3.5 \times 10^{22} \times 1.5 \times 10^{11} \times 1.5 \times 10^{11}}{6.7 \times 10^{-11} \times 6 \times 10^{24}}$$

$$m = 1.96 \times 10^{30} \text{ kg}$$

Ans- The mass of the Sun is  $1.96 \times 10^{30}$  kg.