

Gravitation, Work, Energy and Sound

Science · Class 9 · Topic-wise Practice Worksheet

TIME 45 minutes	QUESTIONS 18	TOTAL MARKS 24	MAX. SCORE ___ / 24
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Name: _____ Class/Sec: _____ Date: _____

INSTRUCTIONS

- There are **18 questions** in this worksheet. All questions are compulsory.
- Each question has four options (A), (B), (C) and (D). Exactly **one** option is correct.
- Questions 1–15 carry **1 mark** each. Questions 16–18 (Achievers Section) carry **3 marks** each.
- Take $g = 10 \text{ m/s}^2$ unless stated otherwise. There is no negative marking.

Section A — Scientific Reasoning

Q1–Q8 · 1 mark each

- According to the universal law of gravitation, the force between two bodies is _____.

(A) Inversely proportional to the square of the distance between them

(B) Directly proportional to the square of the distance between them

(C) Independent of the distance between them

(D) Inversely proportional to the product of their masses
- The acceleration due to gravity near the surface of the earth is about _____.

(A) 1.6 m/s^2

(B) 9.8 m/s^2

(C) 98 m/s^2

(D) $6.67 \times 10^{-11} \text{ m/s}^2$
- When an astronaut travels from the earth to the moon, _____.

(A) Both mass and weight remain the same

(B) Both mass and weight decrease

(C) Mass decreases but weight remains the same

(D) Mass remains the same but weight decreases
- A coolie carries a suitcase on his head and walks horizontally along a platform. The work done by him against gravity is _____.

(A) Zero, because the force and the displacement are perpendicular

(B) Large, because the suitcase is heavy

(C) Equal to the weight of the suitcase

(D) Negative
- The SI unit of work and of energy is the _____.

(A) Newton

(B) Joule

(C) Watt

(D) Pascal
- Power is defined as _____.

(A) Force $\times$ displacement

(B) Energy $\times$ time

(C) The total work done

(D) The rate of doing work
- Sound cannot travel through _____.

(A) Vacuum

(B) Water

(C) Steel

(D) Air

8. The audible range of frequencies for a normal human ear is about _____.
 (A) 2 Hz to 200 Hz (B) 20 Hz to 20 000 Hz
 (C) 20 Hz to 200 Hz (D) 20 000 Hz to 2 000 000 Hz

Section B — Applying What You Know

Q9–Q15 · 1 mark each

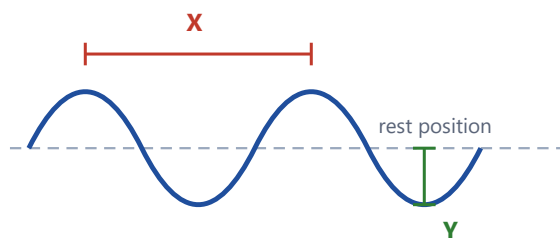
9. The weight of a body of mass 10 kg on the surface of the earth ($g = 9.8 \text{ m/s}^2$) is _____.
 (A) 10 N (B) 9.8 N
 (C) 98 N (D) 980 N
10. An object floats in water. This tells you that the object's density is _____.
 (A) Greater than that of water (B) Zero
 (C) Exactly equal to that of water (D) Less than that of water
11. A force of 50 N moves a box through 4 m in the direction of the force. The work done is _____.
 (A) 200 J (B) 54 J
 (C) 12.5 J (D) 200 W
12. The kinetic energy of a body of mass 2 kg moving at 10 m/s is _____.
 (A) 20 J (B) 100 J
 (C) 200 J (D) 400 J
13. A boy shouts towards a cliff and hears the echo 2 seconds later. If the speed of sound in air is 340 m/s, the cliff is _____ away.
 (A) 170 m (B) 680 m
 (C) 340 m (D) 1360 m
14. One row of the table below is **incorrectly** matched. Which row is it?

Row	Quantity	SI unit
(A)	Frequency	hertz
(B)	Wavelength	metre
(C)	Power	joule
(D)	Time period	second

Table 5.1 — Quantities and their SI units

- (A) (A) (B) (B)
 (C) (C) (D) (D)

15. In the wave shown below, the distance marked X represents the _____.



A wave, with the distance X measured from one crest to the next

- | | |
|---------------|-----------------|
| (A) Amplitude | (B) Time period |
| (C) Frequency | (D) Wavelength |

Achievers Section

Q16–Q18 · 3 marks each

16. **Assertion (A):** A person can jump higher on the moon than on the earth.

Reason (R): The mass of a person on the moon is one-sixth of the mass on the earth.

- | | |
|---|---|
| (A) Both A and R are true and R is the correct explanation of A | (B) Both A and R are true but R is not the correct explanation of A |
| (C) A is true but R is false | (D) A is false but R is true |

17. A stone of mass 5 kg is dropped from a height of 20 m. Taking $g = 10 \text{ m/s}^2$ and ignoring air resistance, its speed just before it strikes the ground is _____.

- | | |
|------------|-------------|
| (A) 20 m/s | (B) 10 m/s |
| (C) 40 m/s | (D) 200 m/s |

18. A tuning fork of frequency 500 Hz is sounded in air, where sound travels at 340 m/s. The wavelength of the sound produced is _____.

- | | |
|------------|------------|
| (A) 1.47 m | (B) 0.68 m |
| (C) 6.8 m | (D) 170 m |

Answer Key

1	A	2	B	3	D	4	A	5	B
6	D	7	A	8	B	9	C	10	D
11	A	12	B	13	C	14	C	15	D
16	C	17	A	18	B				

Solutions

1. **Answer: (A)** Inversely proportional to the square of the distance between them

The law states $F = G \frac{m_1 m_2}{r^2}$: the force grows with the product of the masses but falls off as the square of the separation, so it is **inversely proportional to r^2** . Doubling the distance cuts the force to a quarter.

2. **Answer: (B)** 9.8 m/s^2

Near the earth's surface $g \approx \mathbf{9.8 \text{ m/s}^2}$, often rounded to 10 m/s^2 in calculations. The value 1.6 m/s^2 belongs to the moon, and 6.67×10^{-11} is the gravitational constant G , not an acceleration.

3. **Answer: (D)** Mass remains the same but weight decreases

Mass measures the quantity of matter and does not depend on location, so it **stays the same**. Weight is mg , and since the moon's g is about one-sixth of the earth's, the astronaut's **weight falls to about a sixth**.

4. **Answer: (A)** Zero, because the force and the displacement are perpendicular

The force he applies to hold the suitcase acts vertically upward, while the displacement is horizontal. Since work counts only the component of force along the displacement, the work done against gravity is **zero** — even though he certainly feels tired.

5. **Answer: (B)** Joule

Work = force $\times$ displacement, so its unit is N·m, which is given the name **joule**. Energy is measured in the same unit; the watt is the unit of power, that is one joule per second.

6. **Answer: (D)** The rate of doing work

Power is **the rate of doing work**, that is work done divided by the time taken, measured in watts. Two machines may do the same work, but the faster one has greater power.

7. **Answer: (A)** Vacuum

Sound is a mechanical wave that travels by making particles of a medium vibrate. A **vacuum** has no particles, so sound cannot pass through it — which is why an electric bell ringing inside an evacuated jar becomes silent.

8. **Answer: (B)** 20 Hz to 20 000 Hz

Humans hear frequencies from about **20 Hz to 20 000 Hz**. Below that range the sound is infrasonic and above it ultrasonic, and both lie outside normal hearing.

9. **Answer: (C)** 98 N

Weight $W = mg = 10 \times 9.8 = \mathbf{98 \text{ N}}$. Weight is a force, so it is measured in newtons and not in kilograms.

10. **Answer: (D)** Less than that of water

A floating body displaces a weight of liquid equal to its own weight while remaining partly above the surface, which is possible only when its density is **less than that of water**. A denser object sinks, and one of equal density stays suspended anywhere in the liquid.

11. **Answer: (A)** 200 J

Work = force $\times$ displacement along the force = $50 \times 4 = \mathbf{200 \text{ J}}$. The watt would be wrong here, since it measures power rather than work.

12. **Answer: (B)** 100 J

Kinetic energy = $\frac{1}{2} mv^2 = \frac{1}{2} \times 2 \times 100 = \mathbf{100 \text{ J}}$. Because v is squared, doubling the speed would give four times the energy.

13. **Answer: (C)** 340 m

In 2 s the sound covers $340 \times 2 = 680 \text{ m}$, but that is the distance *there and back*. So the cliff is $680 \div 2 = \mathbf{340 \text{ m}}$ away. Forgetting to halve the distance is the usual error.

14. Answer: (C) (C)

Power is measured in watts; the joule is the unit of work and energy. So row **(C)** is the incorrect one. The other three units are correctly matched.

15. Answer: (D) Wavelength

X is measured from one crest to the next crest, which is one full cycle of the wave — that distance is the **wavelength**. The distance Y, from the rest position down to a trough, is the amplitude. Frequency and time period are measured in hertz and seconds, not in metres.

16. Answer: (C) A is true but R is false

The assertion is true: with the moon's g about one-sixth of the earth's, the same muscular energy lifts a person roughly six times as high. But the reason is false — **mass does not change with location**; it is the *weight* that becomes one-sixth. So A is true and R is false.

17. Answer: (A) 20 m/s

At the top the potential energy is $mgh = 5 \times 10 \times 20 = 1000 \text{ J}$, and all of it becomes kinetic energy at the bottom: $\frac{1}{2}mv^2 = 1000$, so $v^2 = 400$ and $v = \mathbf{20 \text{ m/s}}$. Note the mass cancels — every body dropped from 20 m arrives at the same speed. The same result follows from $v^2 = u^2 + 2gh$.

18. Answer: (B) 0.68 m

The wave relation is $v = f\lambda$, so $\lambda = \frac{v}{f} = \frac{340}{500} = \mathbf{0.68 \text{ m}}$. A higher frequency in the same medium would give a shorter wavelength, since the speed is fixed by the medium.