Motion under gravity

Objective : Application of the 3 equations of motion for freely falling body and a body projected vertically up

Note : Acceleration due to gravity (g) may be approximated as $10ms^{-2}$

1. A body is dropped from a height of 20m. Find its (a) time of descent (b) final velocity.
2. A body dropped from a certain height reaches the ground with a velocity of $30ms^{-1}$. Find (a) the height from which it is dropped (b) time of descent.
3. A body dropped from a certain height reaches the ground in 5 seconds. Find (a) the height from which it is dropped (b) final velocity.
4. A body dropped from a certain height reaches the ground with final velocity v. From what height should it be dropped to reach the ground with velocity $2v$?
5. A body dropped from height H reaches the ground certain time. From what height should it be dropped to reach the ground in half the time?
6. What is the ratio of displacements of a freely falling body in 1s, 2s, 3s and 4s of its motion?
7. A body is projected vertically up with a velocity of $20ms^{-1}$. Find (a) time of ascent (b) maximum height reached by the body (c) time of flight.
8. A body is projected vertically up reaches a maximum height of 60m. Find (a) time of ascent (b) initial velocity of projection (c) time of flight.
9. A body is projected vertically up reaches the maximum height in 5 seconds. Find (a) initial velocity (b) maximum height reached by the body (c) time of flight.
10. A body projected vertically up with velocity u reaches a certain maximum height. With what velocity should it be projected vertically up to reach double the height?
11. A body dropped from a height H reaches the ground in a certain time. Find the height from which it is dropped if it reaches the ground in $1/4^{th}$ the initial time.
12. A body projected vertically up reaches a certain maximum height H. If it is projected vertically up so that its time of ascent is doubled then what is the height attained by it?
13. A body is dropped from a certain height. Find the ratio of time taken by it to cover 1^{st} half of the height to the time taken by it to cover 2^{nd} half of the height.
14. A body is dropped from a certain height. Find the ratio of distances covered by it in 1^{st} half of the time of descent to the distance covered by it in the 2^{nd} half of the time of descent.
15. Acceleration due to gravity on moon is $1/6^{th}$ of the acceleration due to gravity on the earth. If a body is dropped from the same height on the moon and the earth, find the ratio of (a) its time of descent (b) velocity with which it reaches the surface.

Answers

1. (a)2 s (b) 20 ms^{-1}
2. (a)45 m (b) 3 s
3. (a)125 m (b) 50 ms^{-1}
4. $4H$
5. $H/4$
6. 1:4:9:16
7. (a) 2s (b) 20 m (c) 4s
8. (a) $2\sqrt{3}$ s (b) $20\sqrt{3}$ ms^{-1} (c) $4\sqrt{3}$ s
9. (a) 50 ms^{-1} (b) 125 m (c) 10 s
10. $u\sqrt{2}$
11. $H/16$
12. $4H$
13. $1:(\sqrt{2}-1)$
14. 1:3
15. (a) $\sqrt{6}$:1 (b) 1:$\sqrt{6}$