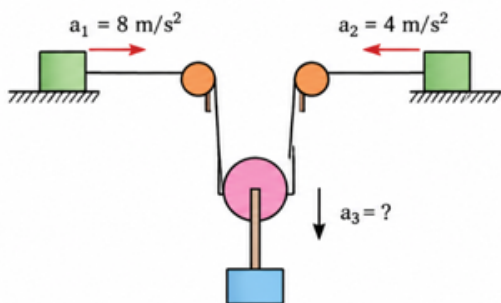


Physics

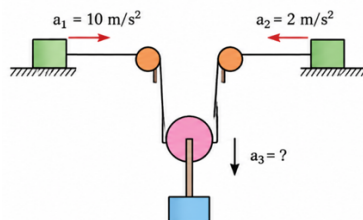
1. Find the acceleration a_3 of the bottom movable pulley in the given pulley system, where the acceleration of the first block is $a_1 = 8 \text{ m/s}^2$ to the right and the acceleration of the second block is $a_2 = 4 \text{ m/s}^2$ to the left. The bottom pulley moves



vertically downward.

- A) 4 m/s^2
 B) 5 m/s^2
 C) 6 m/s^2
 D) 8 m/s^2

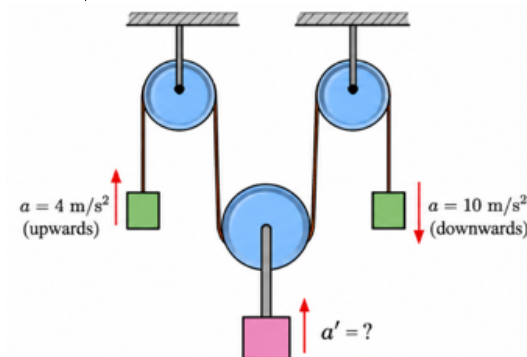
2. Find the acceleration a_3 of the bottom movable pulley in the given pulley system, where the acceleration of the first block is $a_1 = 10 \text{ m/s}^2$ to the right and the acceleration of the second block is $a_2 = 2 \text{ m/s}^2$ to the left. The bottom pulley moves



vertically downward.

- A) 4 m/s^2
 B) 5 m/s^2
 C) 6 m/s^2
 D) 8 m/s^2

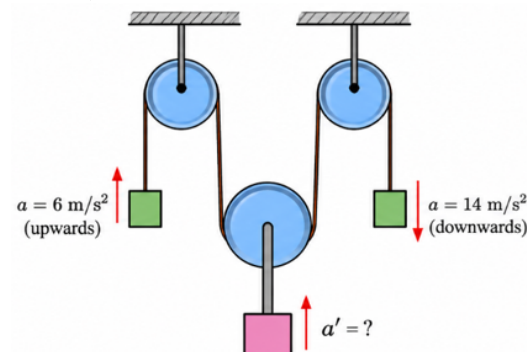
3. Find a' in the following string-pulley system, where the left block moves upwards with acceleration $a_1 = 4 \text{ m/s}^2$ and the right block moves downwards with acceleration $a_2 = 10 \text{ m/s}^2$. Find the magnitude of acceleration of the central



movable pulley.

- A) 2 m/s^2
 B) 3 m/s^2
 C) 4 m/s^2
 D) 7 m/s^2

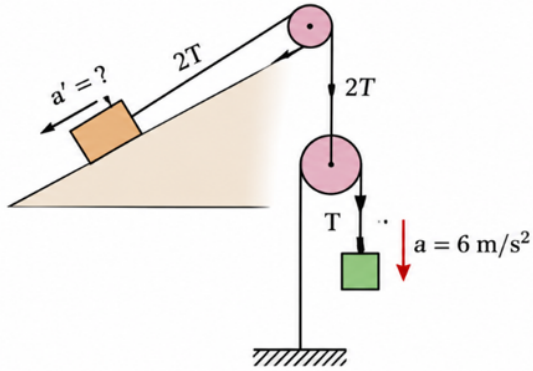
4. Find a' in the following string-pulley system, where the left block moves upwards with acceleration $a_1 = 6 \text{ m/s}^2$ and the right block moves downwards with acceleration $a_2 = 14 \text{ m/s}^2$. Find the magnitude of acceleration of the central



movable pulley.

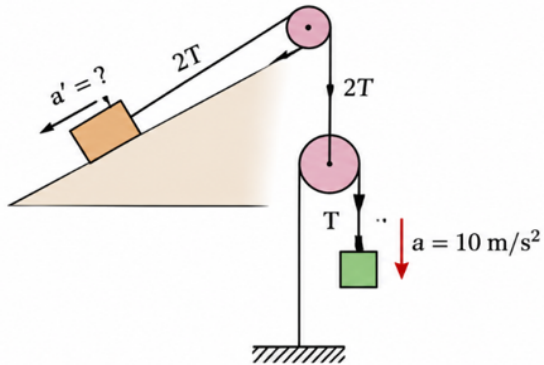
- A) 2 m/s^2
 B) 3 m/s^2
 C) 4 m/s^2
 D) 5 m/s^2

5. Find the acceleration a' of the block on the inclined plane in the given pulley system, where the small block moves downwards with acceleration $a = 6\text{ m/s}^2$.



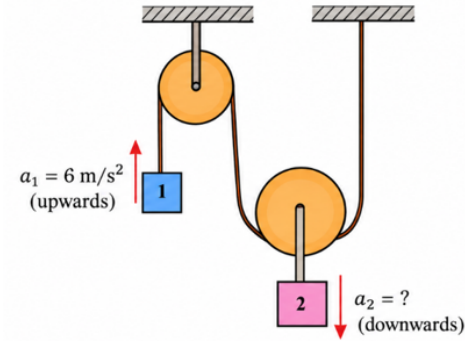
- A) 2 m/s^2
 B) 3 m/s^2
 C) 4 m/s^2
 D) 6 m/s^2

6. Find the acceleration a' of the block on the inclined plane in the given pulley system, where the small block moves downwards with acceleration $a = 10\text{ m/s}^2$.



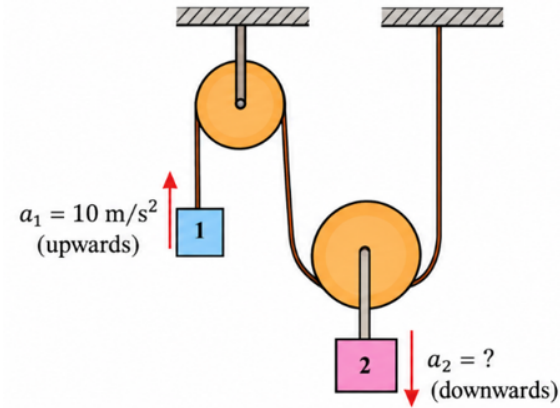
- A) 3 m/s^2
 B) 4 m/s^2
 C) 5 m/s^2
 D) 10 m/s^2

7. Find a_2 in the given pulley system where block 1 moves upwards with acceleration $a_1 = 6\text{ m/s}^2$ and block 2 moves downwards with acceleration a_2 .



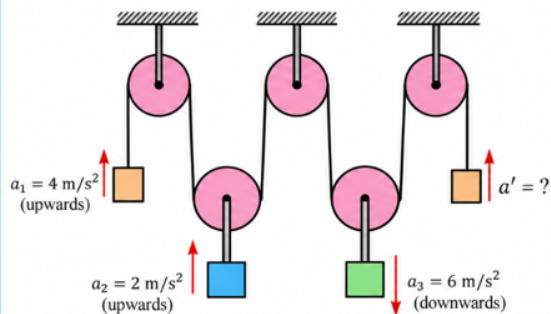
- A) 1 m/s^2
 B) 2 m/s^2
 C) 3 m/s^2
 D) 6 m/s^2

8. Find a_2 in the given pulley system where block 1 moves upwards with acceleration $a_1 = 10\text{ m/s}^2$ and block 2 moves downwards with acceleration a_2 .



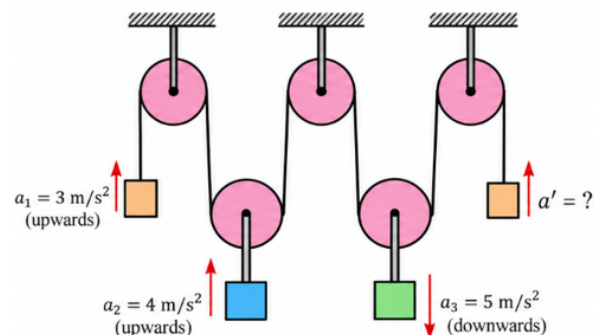
- A) 2 m/s^2
 B) 4 m/s^2
 C) 5 m/s^2
 D) 10 m/s^2

9. Find a' in the given string-pulley system where the first block moves upwards with acceleration $a_1 = 4\text{ m/s}^2$, the second block moves upwards with acceleration $a_2 = 2\text{ m/s}^2$, and the third block moves downwards with acceleration $a_3 = 6\text{ m/s}^2$.



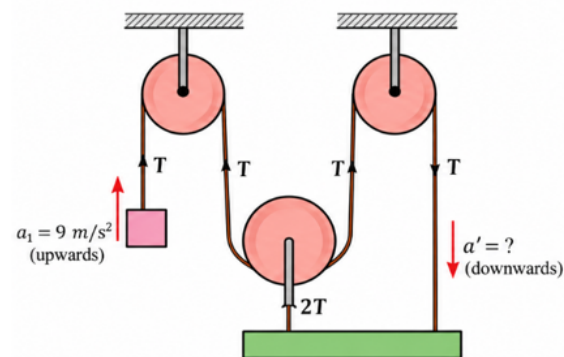
- A) 1 m/s^2
 B) 2 m/s^2
 C) 3 m/s^2
 D) 4 m/s^2

10. Find a' in the given string-pulley system where the first block moves upwards with acceleration $a_1 = 3\text{ m/s}^2$, the second block moves upwards with acceleration $a_2 = 4\text{ m/s}^2$, and the third block moves downwards with acceleration $a_3 = 5\text{ m/s}^2$.



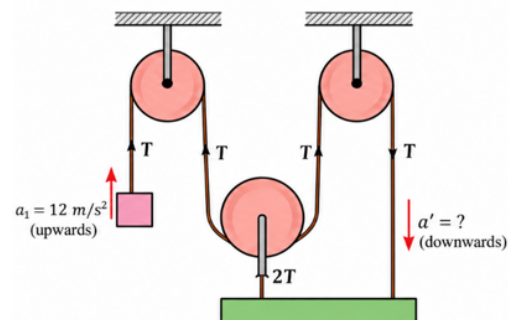
- A) 1 m/s^2
 B) 3 m/s^2
 C) 4 m/s^2
 D) 5 m/s^2

11. Find a' in the given figure where the left block moves upwards with acceleration $a_1 = 9\text{ m/s}^2$ and the green platform moves downwards with acceleration a' .



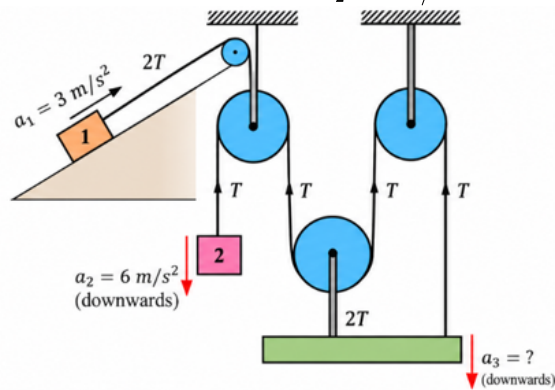
- A) 1 m/s^2
 B) 2 m/s^2
 C) 3 m/s^2
 D) 6 m/s^2

12. Find a' in the given figure where the left block moves upwards with acceleration $a_1 = 12\text{ m/s}^2$ and the green platform moves downwards with acceleration a' .



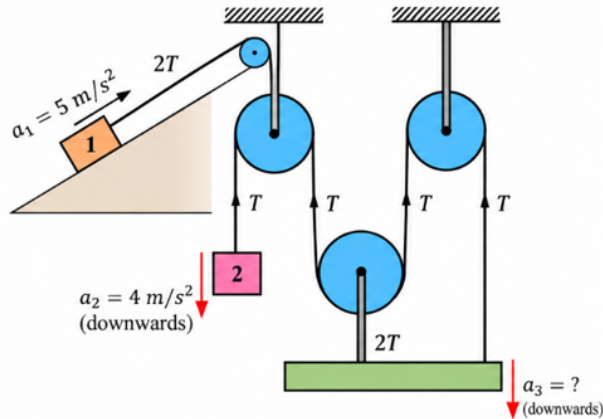
- A) 2 m/s^2
 B) 3 m/s^2
 C) 4 m/s^2
 D) 6 m/s^2

13. Find the acceleration a_3 of the platform in the given string-pulley system where block 1 moves up the incline with acceleration $a_1 = 3m/s^2$ and block 2 moves downwards with acceleration $a_2 = 6m/s^2$.



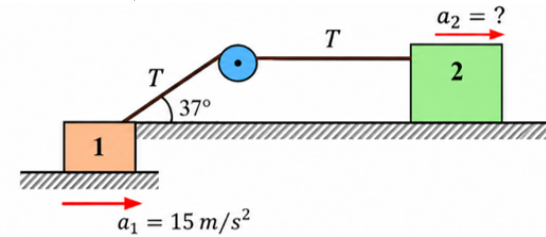
- A) $-2m/s^2$ B) $-3m/s^2$
C) $-4m/s^2$ D) $-5m/s^2$

14. Find the acceleration a_3 of the platform in the given string-pulley system where block 1 moves up the incline with acceleration $a_1 = 5m/s^2$ and block 2 moves downwards with acceleration $a_2 = 4m/s^2$.



- A) $-\frac{10}{3}m/s^2$ B) $-\frac{14}{3}m/s^2$
C) $-\frac{16}{3}m/s^2$ D) $-\frac{18}{3}m/s^2$

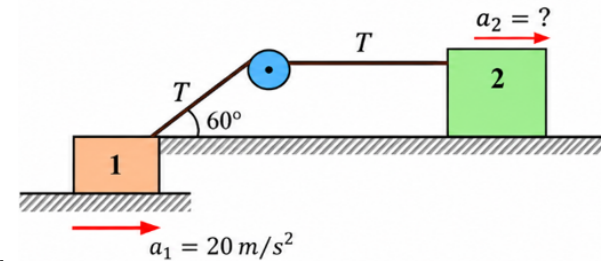
15. Find a_2 in the given system where block 1 moves horizontally to the right with acceleration $a_1 = 15m/s^2$ and the tension T makes an angle of 37° with the



horizontal.

- A) $9m/s^2$ B) $12m/s^2$
C) $15m/s^2$ D) $18m/s^2$

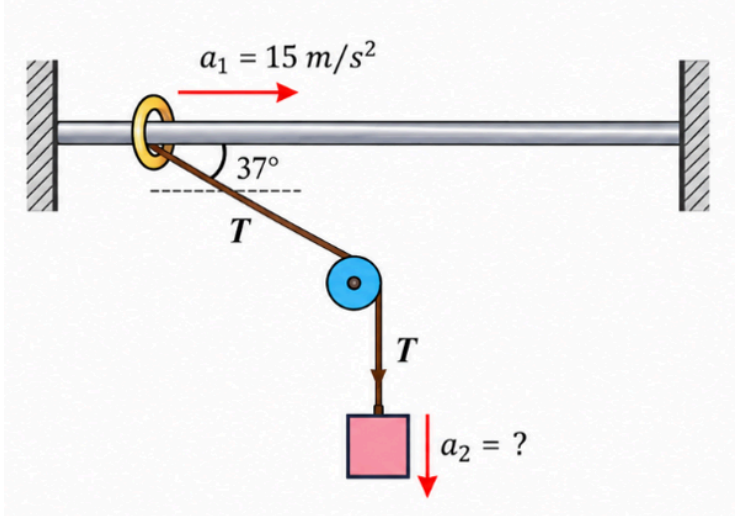
16. Find a_2 in the given system where block 1 moves horizontally to the right with acceleration $a_1 = 20m/s^2$ and the tension T makes an angle of 60° with the



horizontal.

- A) $5m/s^2$ B) $10m/s^2$
C) $15m/s^2$ D) $20m/s^2$

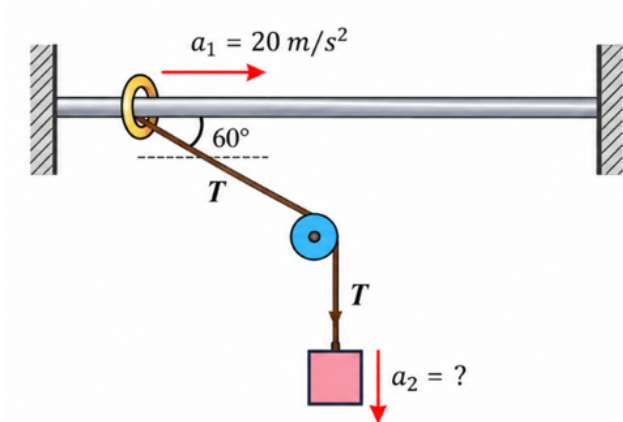
17. Find a_2 in the given system where a ring slides along a horizontal rod with acceleration $a_1 = 15 \text{ m/s}^2$ and the string attached to it makes an angle of 37° with



the rod.

- A) 9 m/s^2 B) 12 m/s^2
C) 15 m/s^2 D) 18 m/s^2

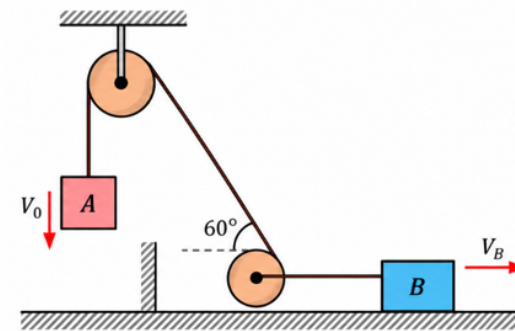
18. Find a_2 in the given system where a ring slides along a horizontal rod with acceleration $a_1 = 20 \text{ m/s}^2$ and the string attached to it makes an angle of 60° with



the rod.

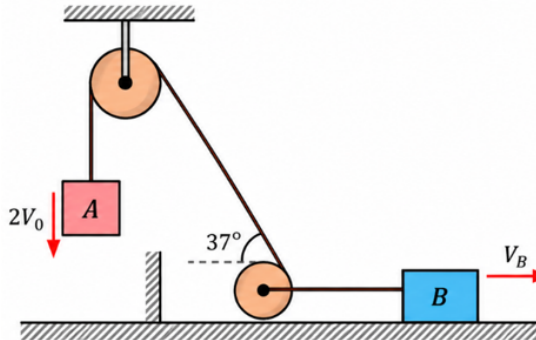
- A) 5 m/s^2 B) 10 m/s^2
C) 15 m/s^2 D) 20 m/s^2

19. In the figure, find the velocity of block B , if the velocity of block A is V_0 in the downward direction and the string makes an angle of 60° with the horizontal.



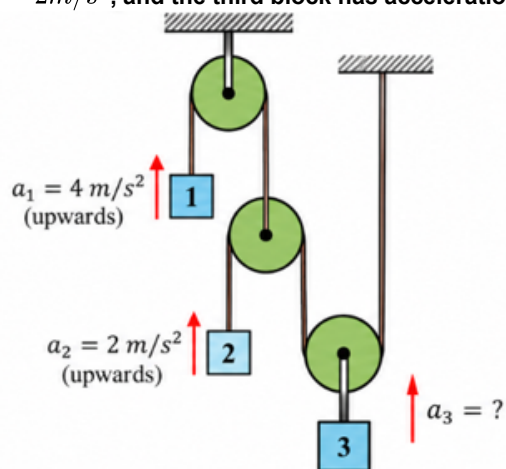
- A) $\frac{V_0}{1 + \cos 60^\circ}$ B) $\frac{V_0}{1 + \sin 60^\circ}$
C) $V_0(1 + \cos 60^\circ)$ D) $\frac{V_0}{\cos 60^\circ}$

20. In the figure, find the velocity of block B , if the velocity of block A is $2V_0$ in the downward direction and the string makes an angle of 37° with the horizontal.



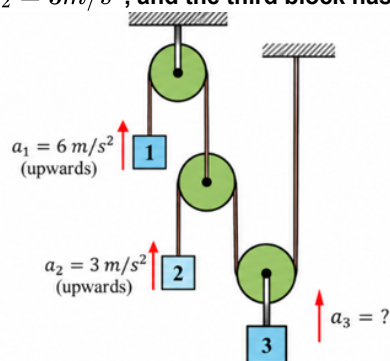
- A) $\frac{2V_0}{1 + \sin 37^\circ}$ B) $\frac{2V_0}{1 + \cos 37^\circ}$
C) $\frac{2V_0}{\cos 37^\circ}$ D) $2V_0(1 + \cos 37^\circ)$

21. Find a_3 in the given string-pulley system where the first block moves upwards with acceleration $a_1 = 4m/s^2$, the second block moves upwards with acceleration $a_2 = 2m/s^2$, and the third block has acceleration a_3 .



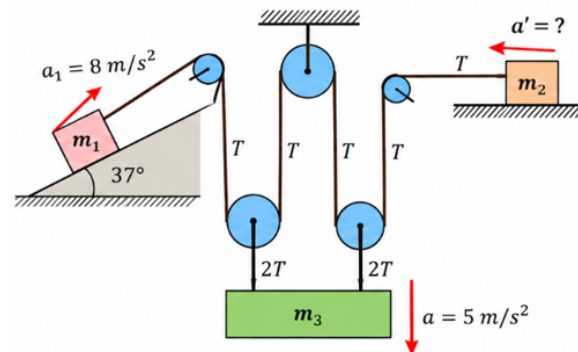
- A) $-2m/s^2$ B) $-3m/s^2$
C) $-4m/s^2$ D) $-6m/s^2$

22. Find a_3 in the given string-pulley system where the first block moves upwards with acceleration $a_1 = 6m/s^2$, the second block moves upwards with acceleration $a_2 = 3m/s^2$, and the third block has acceleration a_3 .



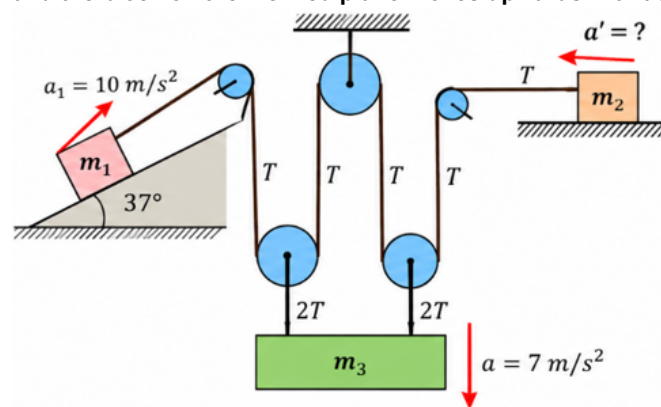
- A) $-3m/s^2$ B) $-4m/s^2$
C) $-5m/s^2$ D) $-6m/s^2$

23. Find the acceleration a' of the block on the horizontal surface in the given pulley system where the bottom platform moves downwards with acceleration $a = 5m/s^2$ and the block on the inclined plane moves upwards with acceleration $a_1 = 8m/s^2$.



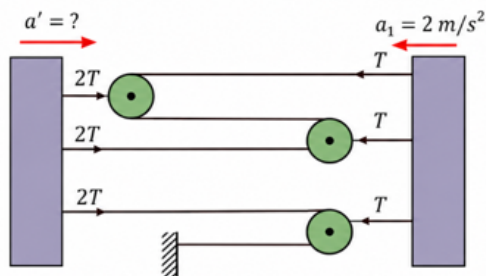
- A) $10m/s^2$ B) $12m/s^2$
C) $14m/s^2$ D) $16m/s^2$

24. Find the acceleration a' of the block on the horizontal surface in the given pulley system where the bottom platform moves downwards with acceleration $a = 7m/s^2$ and the block on the inclined plane moves upwards with acceleration $a_1 = 10m/s^2$.



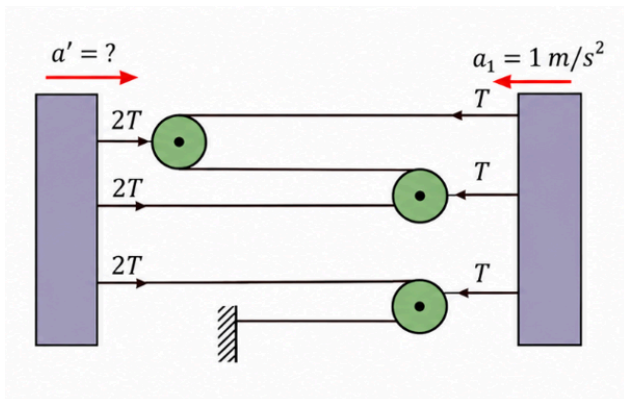
- A) $14m/s^2$ B) $16m/s^2$
C) $18m/s^2$ D) $20m/s^2$

25. In the given string-pulley system, the right block moves horizontally with acceleration $a_1 = 2\text{ m/s}^2$, the intermediate pulley moves with acceleration $a_2 = 6\text{ m/s}^2$, and the lower movable pulley moves with acceleration $a_3 = 4\text{ m/s}^2$. Find the acceleration a' of the left block.



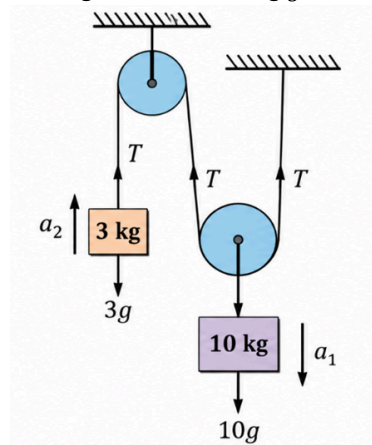
- A) 6 m/s^2 B) 8 m/s^2
C) 10 m/s^2 D) 12 m/s^2

26. In the given string-pulley system, the right block moves horizontally with acceleration $a_1 = 1\text{ m/s}^2$, the intermediate movable pulley moves with acceleration $a_2 = 7\text{ m/s}^2$, and the lower movable pulley moves with acceleration $a_3 = 5\text{ m/s}^2$. Find the acceleration a' of the left block.



- A) 6 m/s^2 B) 8 m/s^2
C) 10 m/s^2 D) 12 m/s^2

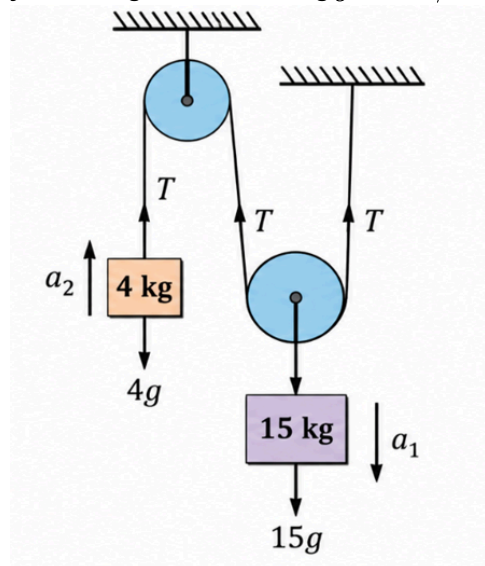
27. A pulley system contains a 3kg block and a 10kg block as shown in the given arrangement. The pulley and string are ideal. Taking $g = 10\text{ m/s}^2$, find the



acceleration of each block.

- A) $a_1 = \frac{20}{11}\text{ m/s}^2$, $a_2 = \frac{40}{11}\text{ m/s}^2$ B) $a_1 = \frac{10}{11}\text{ m/s}^2$, $a_2 = \frac{20}{11}\text{ m/s}^2$
C) $a_1 = \frac{40}{11}\text{ m/s}^2$, $a_2 = \frac{20}{11}\text{ m/s}^2$ D) $a_1 = \frac{20}{11}\text{ m/s}^2$, $a_2 = \frac{20}{11}\text{ m/s}^2$

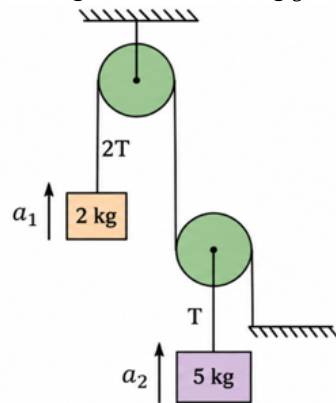
28. A pulley system contains a 4kg block and a 15kg block in the same arrangement as the given system. The pulley and string are ideal. Taking $g = 10\text{ m/s}^2$, find the



acceleration of each block.

- A) $a_1 = \frac{70}{31}\text{ m/s}^2$, $a_2 = \frac{140}{31}\text{ m/s}^2$ B) $a_1 = \frac{35}{31}\text{ m/s}^2$, $a_2 = \frac{70}{31}\text{ m/s}^2$
C) $a_1 = \frac{140}{31}\text{ m/s}^2$, $a_2 = \frac{70}{31}\text{ m/s}^2$ D) $a_1 = \frac{70}{31}\text{ m/s}^2$, $a_2 = \frac{70}{31}\text{ m/s}^2$

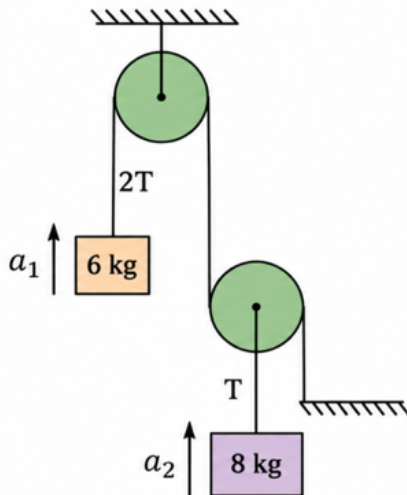
29. A pulley system contains a 2kg block and a 5kg block as shown in the same arrangement. The pulleys and strings are ideal. Taking $g = 10\text{m/s}^2$, find the



acceleration of each block.

- A) $a_1 = \frac{40}{11}\text{m/s}^2$, $a_2 = -\frac{80}{11}\text{m/s}^2$ B) $a_1 = \frac{20}{11}\text{m/s}^2$, $a_2 = -\frac{40}{11}\text{m/s}^2$
 C) $a_1 = \frac{80}{11}\text{m/s}^2$, $a_2 = -\frac{40}{11}\text{m/s}^2$ D) $a_1 = \frac{40}{11}\text{m/s}^2$, $a_2 = -\frac{40}{11}\text{m/s}^2$

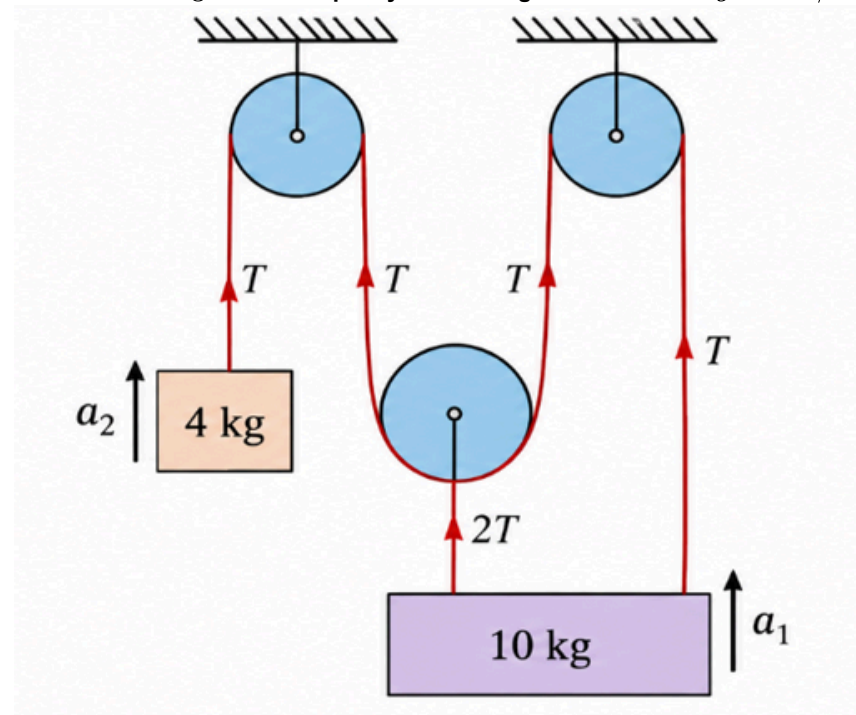
30. A pulley system contains a 6kg block and an 8kg block in the same arrangement. The pulleys and strings are ideal. Taking $g = 10\text{m/s}^2$, find the acceleration of each



block.

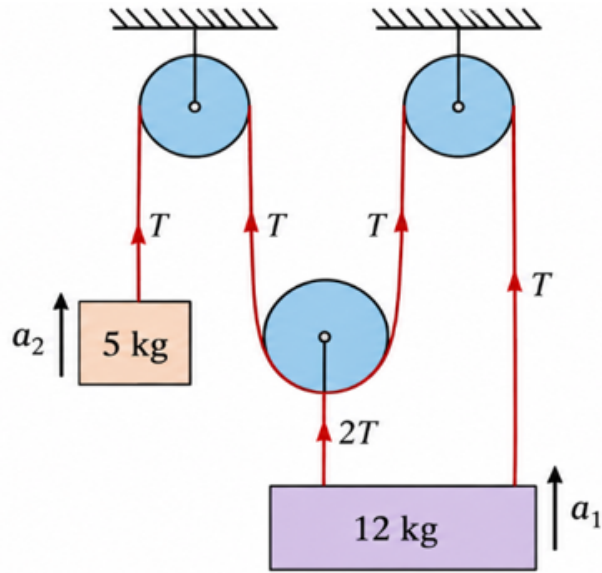
- A) $a_1 = \frac{50}{19}\text{m/s}^2$, $a_2 = -\frac{100}{19}\text{m/s}^2$ B) $a_1 = \frac{25}{19}\text{m/s}^2$, $a_2 = -\frac{50}{19}\text{m/s}^2$
 C) $a_1 = \frac{100}{19}\text{m/s}^2$, $a_2 = -\frac{50}{19}\text{m/s}^2$ D) $a_1 = \frac{50}{19}\text{m/s}^2$, $a_2 = -\frac{50}{19}\text{m/s}^2$

31. Find the acceleration of each block in the given pulley system containing a 4kg block and a 10kg block. The pulleys and strings are ideal. Take $g = 10\text{m/s}^2$.



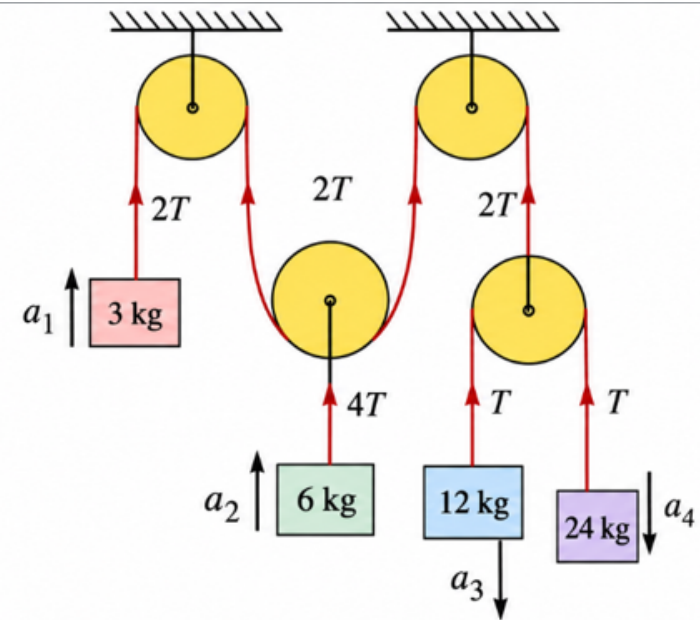
- A) $a_1 = \frac{10}{23}\text{m/s}^2$, $a_2 = -\frac{30}{23}\text{m/s}^2$ B) $a_1 = \frac{15}{23}\text{m/s}^2$, $a_2 = -\frac{45}{23}\text{m/s}^2$
 C) $a_1 = \frac{10}{23}\text{m/s}^2$, $a_2 = -\frac{20}{23}\text{m/s}^2$ D) $a_1 = \frac{20}{23}\text{m/s}^2$, $a_2 = -\frac{30}{23}\text{m/s}^2$

32. Find the acceleration of each block in the same pulley arrangement containing a 5kg block and a 12kg block. The pulleys and strings are ideal. Take $g = 10\text{m/s}^2$.



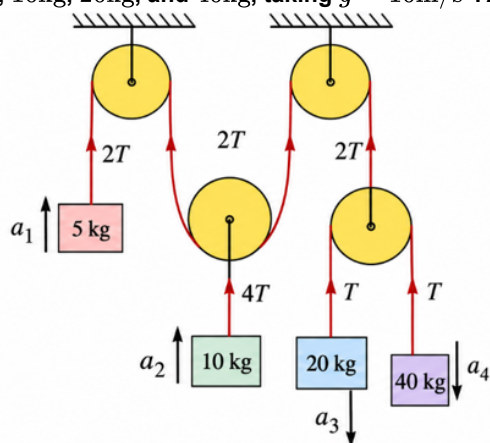
- A) $a_1 = \frac{10}{19} \text{m/s}^2$, $a_2 = -\frac{30}{19} \text{m/s}^2$
 B) $a_1 = \frac{15}{19} \text{m/s}^2$, $a_2 = -\frac{45}{19} \text{m/s}^2$
 C) $a_1 = \frac{10}{19} \text{m/s}^2$, $a_2 = -\frac{20}{19} \text{m/s}^2$
 D) $a_1 = \frac{20}{19} \text{m/s}^2$, $a_2 = -\frac{30}{19} \text{m/s}^2$

33. Find the acceleration of each block in the given pulley system containing blocks of masses 3kg, 6kg, 12kg, and 24kg, taking $g = 10\text{m/s}^2$. Assume ideal pulleys and strings.



- A) $a_1 = \frac{290}{99} \text{m/s}^2$, $a_2 = \frac{290}{99} \text{m/s}^2$, $a_3 = -\frac{830}{99} \text{m/s}^2$, $a_4 = -\frac{145}{99} \text{m/s}^2$
 B) $a_1 = \frac{290}{99} \text{m/s}^2$, $a_2 = \frac{290}{99} \text{m/s}^2$, $a_3 = -\frac{830}{99} \text{m/s}^2$, $a_4 = -\frac{145}{99} \text{m/s}^2$
 C) $a_1 = \frac{580}{99} \text{m/s}^2$, $a_2 = \frac{580}{99} \text{m/s}^2$, $a_3 = -\frac{1660}{99} \text{m/s}^2$, $a_4 = -\frac{290}{99} \text{m/s}^2$
 D) $a_1 = \frac{580}{99} \text{m/s}^2$, $a_2 = \frac{580}{99} \text{m/s}^2$, $a_3 = -\frac{1660}{99} \text{m/s}^2$, $a_4 = -\frac{290}{99} \text{m/s}^2$

34. Find the acceleration of each block in the same pulley arrangement containing blocks of masses 5kg, 10kg, 20kg, and 40kg, taking $g = 10\text{m/s}^2$. Assume ideal



pulleys and strings.

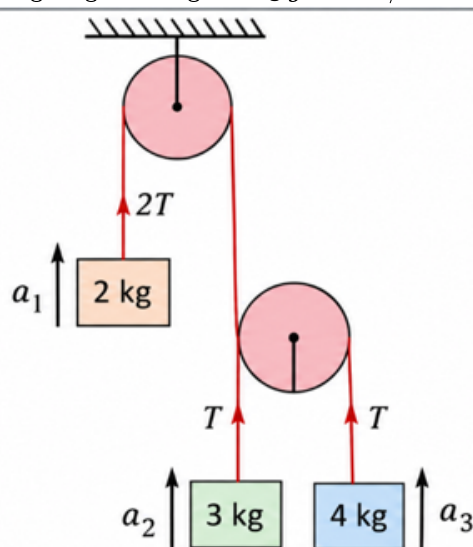
A) $a_1 = \frac{290}{99}\text{m/s}^2$, $a_2 = \frac{290}{99}\text{m/s}^2$, $a_3 = -\frac{830}{99}\text{m/s}^2$, $a_4 = -\frac{1660}{99}\text{m/s}^2$

B) $a_1 = \frac{290}{99}\text{m/s}^2$, $a_2 = \frac{290}{99}\text{m/s}^2$, $a_3 = -\frac{830}{99}\text{m/s}^2$, $a_4 = -\frac{1660}{99}\text{m/s}^2$

C) $a_1 = \frac{145}{99}\text{m/s}^2$, $a_2 = \frac{145}{99}\text{m/s}^2$, $a_3 = -\frac{415}{99}\text{m/s}^2$, $a_4 = -\frac{830}{99}\text{m/s}^2$

D) $a_1 = \frac{145}{99}\text{m/s}^2$, $a_2 = \frac{145}{99}\text{m/s}^2$, $a_3 = -\frac{415}{99}\text{m/s}^2$, $a_4 = -\frac{830}{99}\text{m/s}^2$

35. Find the acceleration of each block in the given pulley system containing blocks of masses 2kg, 3kg, and 4kg, taking $g = 10\text{m/s}^2$. Assume the pulleys and strings are



ideal.

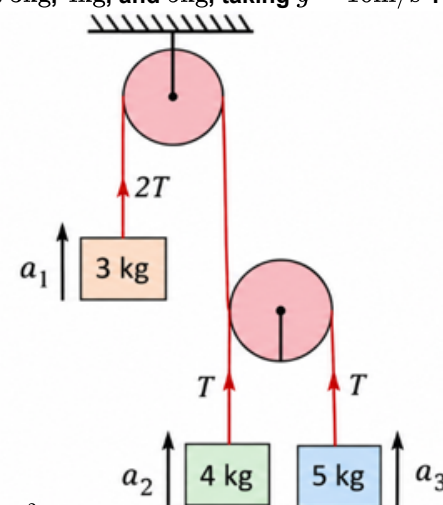
A) $a_1 = \frac{170}{31}\text{m/s}^2$, $a_2 = -\frac{150}{31}\text{m/s}^2$, $a_3 = -\frac{190}{31}\text{m/s}^2$

B) $a_1 = \frac{170}{31}\text{m/s}^2$, $a_2 = -\frac{150}{31}\text{m/s}^2$, $a_3 = -\frac{190}{31}\text{m/s}^2$

C) $a_1 = \frac{170}{31}\text{m/s}^2$, $a_2 = -\frac{300}{31}\text{m/s}^2$, $a_3 = -\frac{340}{31}\text{m/s}^2$

D) $a_1 = \frac{170}{31}\text{m/s}^2$, $a_2 = -\frac{300}{31}\text{m/s}^2$, $a_3 = -\frac{340}{31}\text{m/s}^2$

36. Find the acceleration of each block in the same pulley arrangement containing blocks of masses 3kg, 4kg, and 5kg, taking $g = 10\text{m/s}^2$. Assume the pulleys and



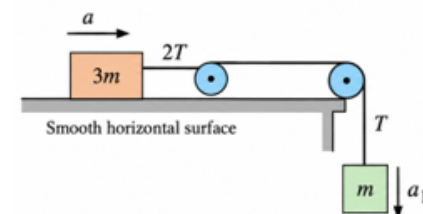
A) $a_1 = \frac{530}{107}\text{m/s}^2$, $a_2 = -\frac{940}{107}\text{m/s}^2$, $a_3 = -\frac{1180}{107}\text{m/s}^2$

B) $a_1 = \frac{530}{107}\text{m/s}^2$, $a_2 = -\frac{940}{107}\text{m/s}^2$, $a_3 = -\frac{1180}{107}\text{m/s}^2$

C) $a_1 = \frac{530}{107}\text{m/s}^2$, $a_2 = -\frac{940}{107}\text{m/s}^2$, $a_3 = -\frac{1180}{107}\text{m/s}^2$

D) $a_1 = \frac{530}{107}\text{m/s}^2$, $a_2 = -\frac{940}{107}\text{m/s}^2$, $a_3 = -\frac{1180}{107}\text{m/s}^2$

37. Find the acceleration of the hanging mass m in the given string-pulley system, where a block of mass $3m$ rests on a smooth horizontal surface and block m hangs



vertically. The pulleys and string are ideal.

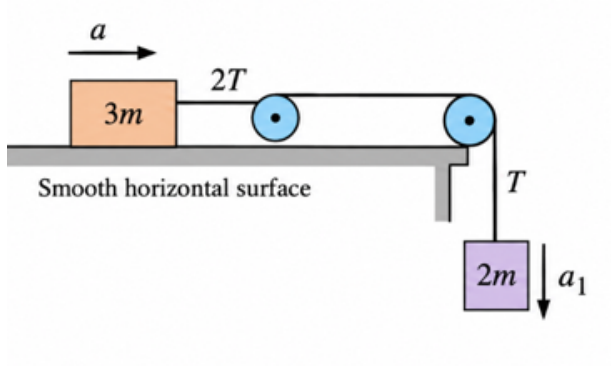
A) $\frac{2g}{7}$

B) $\frac{4g}{7}$

C) $\frac{3g}{7}$

D) $\frac{5g}{7}$

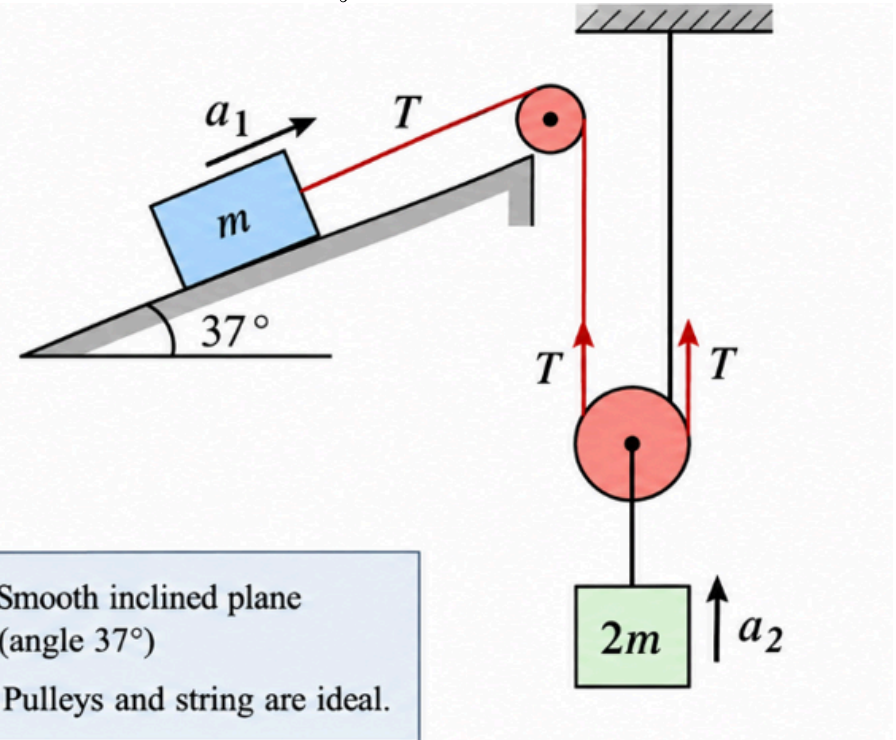
38. Find the acceleration of the hanging block of mass $2m$ in the given string-pulley system, where a block of mass $3m$ rests on a smooth horizontal surface and the block $2m$ hangs vertically. The pulleys and string are ideal.



- A) $\frac{6g}{11}$
C) $\frac{4g}{11}$

- B) $\frac{8g}{11}$
D) $\frac{10g}{11}$

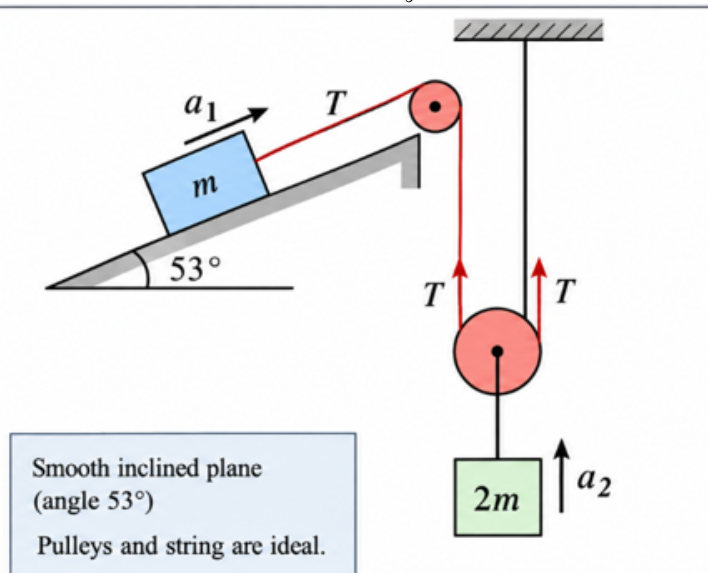
39. Find the acceleration of both blocks in the given string-pulley system, where a block of mass m is on a smooth inclined plane of angle 37° and a block of mass $2m$ is hanging vertically. Take $\sin 37^\circ = \frac{3}{5}$.



- A) $a_1 = \frac{4g}{15}, \quad a_2 = -\frac{2g}{15}$
C) $a_1 = \frac{g}{5}, \quad a_2 = -\frac{g}{10}$

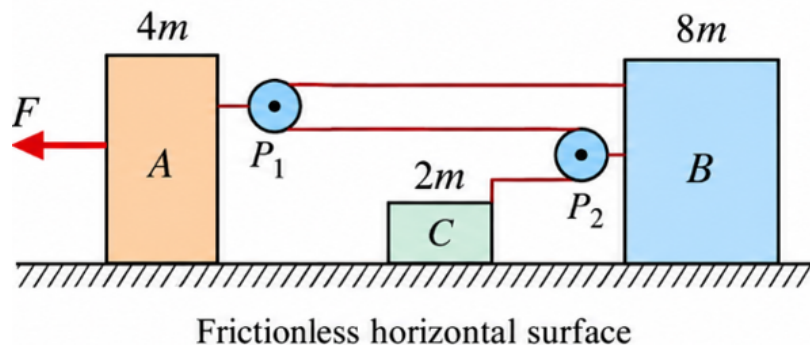
- B) $a_1 = \frac{2g}{15}, \quad a_2 = -\frac{g}{15}$
D) $a_1 = \frac{2g}{5}, \quad a_2 = -\frac{g}{5}$

40. Find the acceleration of both blocks in the same string-pulley arrangement, where a block of mass m is on a smooth inclined plane of angle 53° and a block of mass $2m$ is hanging vertically. Take $\sin 53^\circ = \frac{4}{5}$.



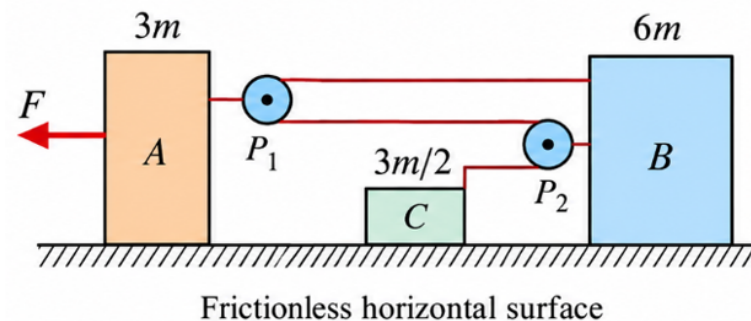
- A) $a_1 = \frac{g}{5}$, $a_2 = -\frac{g}{10}$
 B) $a_1 = \frac{2g}{15}$, $a_2 = -\frac{g}{15}$
 C) $a_1 = \frac{4g}{15}$, $a_2 = -\frac{2g}{15}$
 D) $a_1 = \frac{g}{3}$, $a_2 = -\frac{g}{6}$

41. In the same pulley arrangement, block A has mass $4m$, block B has mass $8m$, and block C has mass $2m$. If a horizontal force F acts on block A toward the left and all surfaces are frictionless, find the acceleration of block B .



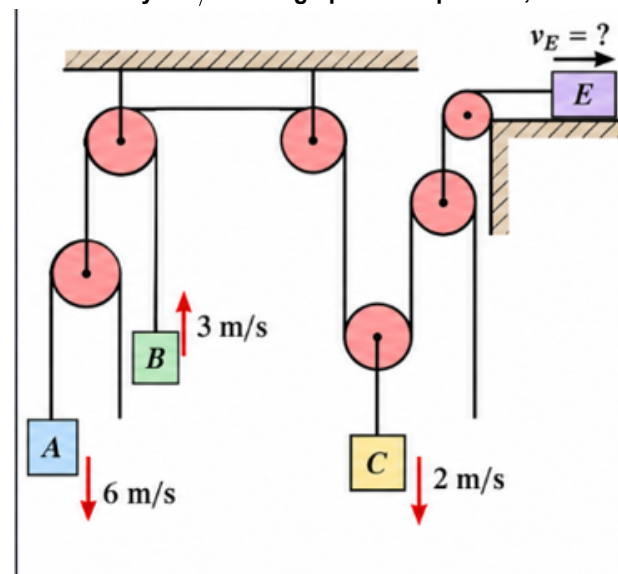
- A) $\frac{F}{14m}$
 B) $\frac{F}{7m}$
 C) $\frac{2F}{7m}$
 D) $\frac{F}{21m}$

42. In the same pulley arrangement, block A has mass $3m$, block B has mass $6m$, and block C has mass $\frac{3m}{2}$. A horizontal force F acts on block A toward the left and all surfaces are frictionless. Find the acceleration of block B .



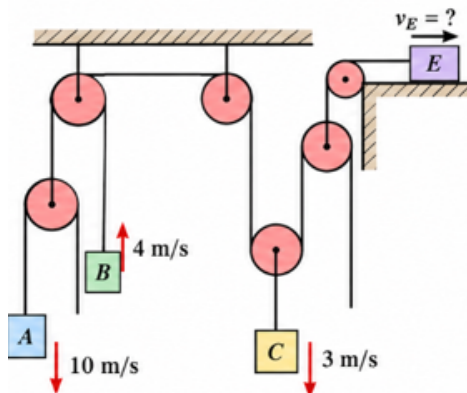
- A) $\frac{F}{21m}$
 B) $\frac{2F}{21m}$
 C) $\frac{F}{14m}$
 D) $\frac{3F}{14m}$

43. In a similar compound string-pulley system, block A moves downward with velocity 6 m/s , block B moves upward with velocity 3 m/s , and block C moves downward with velocity 2 m/s . Taking upward as positive, find the velocity of block E .



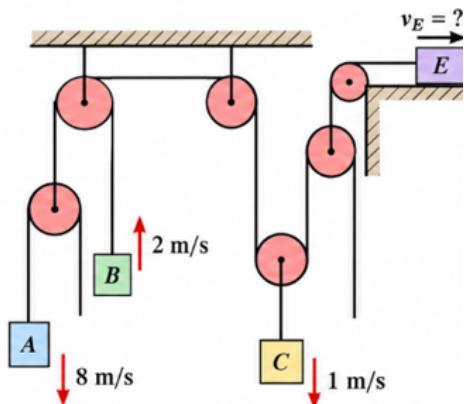
- A) 6 m/s upward
 B) 8 m/s upward
 C) 10 m/s upward
 D) 12 m/s upward

44. In another similar compound string-pulley system, block *A* moves downward with velocity 10m/s, block *B* moves upward with velocity 4m/s, and block *C* moves downward with velocity 3m/s. Taking upward as positive, find the velocity of block *E*.



- A) 11m/s upward
B) 13m/s upward
C) 15m/s upward
D) 17m/s upward

45. In a compound string-pulley system, take upward velocity as positive. Block *A* moves downward with velocity 8m/s, block *B* moves upward with velocity 2m/s, and block *C* moves downward with velocity 1m/s. Find the velocity of block *E*.



- A) 11m/s upward
B) 13m/s upward
C) 15m/s upward
D) 17m/s upward

Chemistry

46. 1 cc N_2O at N.T.P. contains:

- A) 1.8224×10^{22} atoms
B) $\frac{6.02}{22400} \times 10^{23}$ molecules
C) $\frac{1.32}{224} \times 10^{23}$ electrons
D) All of the above

47. At S.T.P. the density of CCl_4 vapour in g/L will be nearest to:

- A) 6.87
B) 3.42
C) 10.26
D) 4.57

48. The number of oxygen atoms in 4.4 g of CO_2 is:

- A) 1.2×10^{23}
B) 6×10^{22}
C) 6×10^{23}
D) 12×10^{23}

49. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At $15^\circ C$ and 150 mmHg pressure, one litre of O_2 contains "*N*" molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be:

- A) $\frac{N}{2}$
B) *N*
C) 2*N*
D) 4*N*

50. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is:

- A) 10 g molecules
B) 5 g molecules
C) 1 g molecule
D) 0.5 g molecules

51. A 5 molar solution of H_2SO_4 is diluted from 1 litre to a volume of 10 litres, the normality of the solution will be:

- A) 1N
B) 0.1N
C) 5N
D) 0.5N

52. The total number of valence electrons in 4.2 g of N_3^- ion is (N_A is the Avogadro's number):

- A) $2.1N_A$
B) $4.2N_A$
C) $1.6N_A$
D) $3.2N_A$

53. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is:

- A) 0.0093 mol
B) 2.10 mol
C) 0.186 mol
D) 0.21 mol

54. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of haemoglobin is:

- A) 4
B) 6
C) 3
D) 2

A) 1×10^{23} **B)** 2×10^{23}
C) 4×10^{23} **D)** 6×10^{23}

A) $A_2(BC_2)_2$ **B)** $A_3(BC_4)_2$
C) $A_2(BC_3)_2$ **D)** $A_3(B_2C)_2$

A) 36.5 **B) 18.25**
C) 32.05 **D) 42.10**

A) 1.568×10^4

B) 1.568×10^3

C) 15.68

D) 2.136×10^4

A) 7 g N_2
B) 2 g H_2
C) 16 g NO_2
D) 16 g O_2

A) 15, L of H_2 gas at STP
B) 5, L of N_2 gas at STP
C) 0.5, g of H_2 gas
D) 10, g of O_2 gas

A) 6.026×10^{22}

B) 1.806×10^{23}

C) 3.600×10^{21}

D) 1.800×10^{22}

A) 44 g CO_2

B) 48 g O_3

C) 8 g H_2

D) 64 g SO_2

A) 0.001 M **B)** 0.1 M
C) 0.02 M **D)** 0.01 M

A) 8 : 16 : 1

B) 16 : 8 : 1

C) 16 : 1 : 2

D) 8 : 1 : 2

A) 16 : 1

B) 2 : 1

C) 1 : 4

D) 4 : 1

A) the mass of one mole of carbon

A) 1.8 gram of water
B) 18 gram of water
C) 18 moles of water
D) 18 molecules of water

A) 40, 30 **B)** 60, 40
C) 20, 30 **D)** 30, 20

A) 18 mL of water
B) 0.18 g of water
C)
D) 10^{-3} mol of water
0.00224 L of water vapours at 1 atm and 273K

A) 1.20m

B) 1.56m

C) 1.67m

D) 1.32m

A 1 g of Mg(s) [Atomic mass of Mg = 24] **B** 1 g of O_2 [Atomic mass of O = 16]
C 1 g of Li(s) [Atomic mass of Li = 7] **D** 1 g of Ag(s) [Atomic mass of Ag = 108]

- A) 0.705 m**
- B) 1.20 m**
- C) 1.165 m**
- D) 0.858 m**

- A) 4 mol of helium** **B) 4 u of helium**
C) 4 g of helium **D) 2.271098 L of helium at STP**

- A)** 14 g of N_2
B) 18 g of H_2O
C) 16 g of CO
D) 28 g of N_2

- A) 2.25 g**
- B) 4.5 g**
- C) 0.44 g**
- D) 1.125 g**

- A) 11** **B) 34**
C) 19 **D) 18**

- A) 471** **B) 288**
C) 589 **D) 364**

- A)** 7.527×10^{22} and 0.125 mol **B)** 1.505×10^{23} and 0.250 mol
C) 7.527×10^{23} and 0.125 mol **D)** 7.527×10^{22} and 0.250 mol

- A)** A is false but R is true
- B)** A is true but R is false
- C)** Both A and R are true but R is NOT the correct explanation of A
- D)** Both A and R are true and R is the correct explanation of A

LIST I	LIST II
A 16g of CH ₄ (g)	I. Weight 28g
B 1g of H ₂ (g)	II 60.2 × 10 ²³ electrons
C 1 mole of N ₂ (g)	III Weight 32g
D 0.5 mol of SO ₂ (g)	IV Occupies 11.4L volume at STP

- A)** A-II, B-IV, C-I, D-III
B) A-II, B-IV, C-III, D-I
C) A-II, B-III, C-IV, D-I
D) A-I, B-III, C-II, D-IV

- A) 5%**
- B) 20%**
- C) 15%**
- D) 10%**

- A) 10.2 M** **B) 12.5 M**
C) 14.0 M **D) 18.2 M**

- A)** 1.21×10^5 **B)** 12.0×10^{16}
C) 1.21×10^{20} **D)** 3.4×10^{22}

- A) 1.03** **B) 2.06**
C) 3.09 **D) 5.40**

- A) 4**
- B) 9**
- C) 1**
- D) 8**

- A) 64** **B) 87**
C) 17 **D) 88**

87. The number of atoms in 8 g of sodium is $x \times 10^{23}$. The value of x is (Nearest integer) [Given : $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, Atomic mass of $Na = 23.0 \text{ u}$]

- A) 4
C) 1
- B) 2
D) 8

88. The molarity of HNO_3 in a sample which has density 1.4 g mL^{-1} and mass percentage of 63% is _____. (Molecular Weight of $HNO_3 = 63$)

- A) 14
C) 1
- B) 9
D) 8

89. 10.30 mg of O_2 is dissolved into a liter of sea water of density 1.03 g mL^{-1} . The concentration of O_2 in ppm is _____.

- A) 4
C) 1
- B) 9
D) 10

90. The mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is _____.

- A) 47
C) 87
- B) 93
D) 16

Botany

91. Which of the following statements is INCORRECT regarding the characteristics of a leaf?

- A) It originates from the shoot apical meristem.
C) Leaves are arranged in a basipetal order on the stem.
- B) It develops at the node and bears a bud in its axil.
D) It is the primary site of photosynthesis.

92. The green, expanded part of the leaf that contains veins and veinlets is known as the:

- A) Petiole
C) Lamina
- B) Pulvinus
D) Stipule

93. In some leguminous plants, the leaf base becomes swollen. This swollen structure is called a:

- A) Pulvinus
C) Ligule
- B) Stipule
D) Sheathing leaf base

94. Reticulate venation is a characteristic feature of most:

- A) Monocotyledonous plants
C) Pteridophytes
- B) Dicotyledonous
D) Gymnosperms

95. A leaf is considered a complex/compound leaf when:

- A) The lamina is completely entire.
C) The incisions of the lamina reach up to the midrib, breaking it into a number of leaflets.
- B) The incisions of the lamina do not touch the midrib.
D) Axillary buds are present in the axil of the leaflets.

96. In a pinnately compound leaf, a common axis exists on which leaflets are arranged. This axis represents the midrib and is called the:

- A) Petiole
C) Peduncle
- B) Rachis
D) Phyllode

97. Silk cotton (*Bombax*) features which type of leaf pattern?

- A) Simple leaf
C) Palmately compound leaf
- B) Pinnately compound leaf
D) Alternating leaf

98. Identify the correct pattern of phyllotaxy where a pair of leaves arise at each node opposite to each other:

- A) Alternate as in Mustard
C) Whorled as in Alstonia
- B) Opposite as in Calotropis and Guava
D) Spiral as in China rose

99. If more than two leaves arise at a node and form a ring, the phyllotaxy is called:

- A) Alternate
C) Whorled
- B) Opposite decussate
D) Palmate

100.

In pea plants (*Pisum sativum*), leaves are modified into climbing structures known as:

- A) Spines
C) Hooks
- B) Tendrils
D) Phyllodes

101.

In *Opuntia* (Cactus), true leaves are modified into:

- A) Tendrils
C) Spines
- B) Photosynthetic flat stems
D) Scales

102.

Fleshy, scale-like leaves modified for food storage are found in:

- A) Garlic and Onion
C) Aloe and Cactus
- B) Pea and Bean
D) Mustard and Sunflower

103.

In Australian Acacia, the true leaves are short-lived, and the petioles expand, turn green, and synthesize food. These modified petioles are called:

- A) Phylloclades
- B) Cladodes
- C) Phyllodes
- D) Scale leaves

104.

In insectivorous plants like the Pitcher plant (Nepenthes), the structural trap (pitcher) is an evolutionary modification of the:

- A) Stem
- B) Leaf lamina
- C) Root
- D) Bract

105.

The bladder of Utricularia (Bladderwort) represents a modification of:

- A) Stem
- B) Root
- C) Submerged leaves
- D) Flowers

106.

Identify the correct sequence of floral opening in a cymose inflorescence:

- A) Centripetal (outer/older flowers open first, younger towards the center)
- B) Centrifugal (inner/central older flower opens first, younger towards the periphery)
- C) Acropetal (bottom flowers open first, top buds open last)
- D) Irregular and asynchronous opening

107.

Assertion: The arrangement of flowers on the floral axis in a mustard plant is called acropetal succession. Reason: In a racemose inflorescence like mustard, the older flowers are pushed toward the base while new floral buds emerge at the apex.

- A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- B) Both Assertion and Reason are true but Reason is NOT the correct explanation of Assertion.
- C) Assertion is true but Reason is false.
- D) Both Assertion and Reason are false.

108.

Match the architectural stalk terms with their exact botanical function: 1. Peduncle — Stalk of an entire inflorescence axis. 2. Pedicel — Stalk supporting an individual flower within an inflorescence. 3. Petiole — Stalk linking a leaf blade to the stem. If a plant produces sessile flowers in a racemose succession, what structural change has occurred?

- A) The peduncle is completely absent.
- B) The individual flowers lack a pedicel.
- C) The flowers lack a thalamus.
- D) The flowers are missing their bracts.

109.

Read the following statements and choose the correct option: Statement I: When a shoot tip transforms into a solitary flower, it is always a determinate growth structure. Statement II: In a cymose inflorescence, the main axis terminates in a flower, hence its growth is limited.

- A) Both Statement I and Statement II are correct.
- B) Both Statement I and Statement II are incorrect.
- C) Statement I is correct but Statement II is incorrect.
- D) Statement I is incorrect but Statement II is correct.

110.

Which of the following sets contains only actinomorphic flowers?

- A) Pea, Broad bean, Cassia
- B) Mustard, Datura, Chilli
- C) Canna, Gulmohur, Bean
- D) Datura, Canna, Cassia

111.

Which of the following plants displays an asymmetric (irregular) floral symmetry?

- A) Mustard
- B) Datura
- C) Canna
- D) Chilli

112.

Read the following features: Ray florets of sunflower Enclosed inferior ovary Thalamus margins grow upward to completely fuse with the ovary wall Which floral condition is being described?

- A) Hypogynous
- B) Perigynous
- C) Epigynous
- D) Superior ovary

113.

In pea and bean flowers, the standard petal overlaps two lateral wing petals, which in turn overlap two anterior keel petals. This type of aestivation is called:

- A) Valvate
- B) Twisted
- C) Imbricate
- D) Vexillary

114.

Match the stamen conditions with their correct examples: Epipetalous --> Brinjal Epiphyllous --> Lily Monadelphous --> China rose Diadelphous --> Pea Polyadelphous --> Citrus Which of the following represents a correct combination?

- A) Epipetalous - Lily; Epiphyllous - Brinjal
- B) Epipetalous - Brinjal; Diadelphous - Pea
- C) Monadelphous - Citrus; Polyadelphous - China rose
- D) Polyadelphous - Pea; Diadelphous - Citrus

115.

Match Column I with Column II:

Column I (Aestivation)	Column II (Example)
a. Valvate	i. <i>Cassia</i> , Gulmohar
b. Twisted	ii. <i>Calotropis</i>
c. Imbricate	iii. Cotton, Lady's finger, China rose
d. Vexillary	iv. Pea, Bean

A) a-ii, b-iii, c-i, d-iv

B) a-i, b-ii, c-iii, d-iv

C) a-iv, b-iii, c-i, d-ii

D) a-ii, b-i, c-iii, d-iv

116.

Epipetalous stamens are found in _____, whereas epiphyllous stamens are found in _____.

A) Brinjal, Lily

B) Lily, Brinjal

C) China rose, Citrus

D) Pea, Mustard

117.

Citrus flowers exhibit which of the following stamen arrangements?

A) Monadelphous

B) Diadelphous

C) Polyadelphous

D) Syngenesious

118.

Variation in the length of stamen filaments within a single flower is characteristically observed in:

A) Pea and Bean

B) Salvia and Mustard

C) China rose and Cotton

D) Sunflower and Marigold

119.

Read the following statements regarding floral whorls: Sterile stamens are known as staminodes. Apocarpous pistils are found in Mustard and Tomato. In vexillary aestivation, the smallest anterior petals are fused and called keel. Perianth is the term used when calyx and corolla are distinct. Which of the above statements are CORRECT?

A) 1 and 2 only

B) 1 and 3 only

C) 2 and 4 only

D) 3 and 4 only

120.

A typical angiosperm anther is described as:

A) Unilobed and Monothealous

B) Bilobed and Dithealous

C) Bilobed and Monothealous

D) Multilobed and Polythealous

121.

Read the following statements regarding the Leaf: (I) A leaf is developed at the node and bears a bud in its axil. (II) In pinnately compound leaves, leaflets are attached at a common point, i.e., at the tip of the petiole. (III) Leaves of Australian acacia expand, become green, and synthesize food when petioles modify into phyllodes. (IV) Parallel venation is predominantly found in dicotyledonous plants. Which of the above statements are CORRECT?

A) I and II only

B) I and III only

C) II and IV only

D) III and IV only

122.

Statement I: In racemose inflorescence, the main axis continues to grow and flowers are borne laterally in a basipetal order. Statement II: In cymose inflorescence, the main axis terminates in a flower, limiting its growth.

A) Both Statement I and Statement II are correct.

B) Both Statement I and Statement II are incorrect.

C) Statement I is correct but Statement II is incorrect.

D) Statement I is incorrect but Statement II is correct.

123.

Whorled phyllotaxy with simple leaves is characteristically found in:

A) Mustard

B) China rose

C) Alstonia

D) Calotropis

124.

Rays florets of sunflower have:

A) Superior ovary

B) Hypogynous flower

C) Inferior ovary

D) Half-inferior ovary

125.

Radial symmetry (actinomorphic) is found in the flowers of:

- A) Brassica (Mustard) B) Canna
C) Cassia D) Gulmohur

126.

Staminode refers to a:

- A) Stamen attached to petals B) Sterile stamen
C) Stamen with variable length filaments D) Stamen attached to perianth

127.

Polyadelphous condition is observed in:

- A) Pea B) China rose
C) Citrus D) Brinjal

128.

Match Column-I (Plant Part/Modification) with Column-II (Example):

Column-I	Column-II
A. Leaf tendril	1. <i>Onion</i>
B. Fleshy leaf	2. <i>Pea</i>
C. Leaf spine	3. <i>Australian acacia</i>
D. Phyllode	4. <i>Cactus</i>

- A) A-2, B-1, C-4, D-3 B) A-1, B-2, C-3, D-4
C) A-2, B-4, C-1, D-3 D) A-3, B-1, C-4, D-2

129.

Read the following statements regarding flower structure: (I) Epigynous flowers have an inferior ovary. (II) Perigynous flowers are found in Plum, Rose, and Peach. (III) Twisted aestivation is seen when margins of sepals or petals overlap one another without any particular direction. (IV) Epipetalous stamens are found in Lily. Which of the above statements are CORRECT?

- A) I and II only B) I, II, and III
C) II and IV only D) I and IV only

130.

Match the following androecium conditions with their structural description:

Column-I	Column-II
A. Syngenesious	1. Stamens fused to perianth
B. Synandrous	2. Anthers fused, filaments free
C. Epiphyllous	3. Both anthers and filaments fused completely
D. Polyadelphous	4. Stamens fused into more than two groups

- A) A-2, B-3, C-1, D-4 B) A-3, B-2, C-4, D-1
C) A-1, B-4, C-2, D-3 D) A-2, B-1, C-3, D-4

131.

Read the following statements regarding flower structure: (I) The calyx and corolla are accessory organs, while androecium and gynoecium are reproductive organs. (II) In flowers like lily, calyx and corolla are not distinct and are termed perianth. (III) When stamens are attached to the perianth, as in the flowers of brinjal, they are called epiphyllous. (IV) A sterile stamen is called a staminode. Which of the statements given above are CORRECT?

- A) I, II, and IV B) I and III only
C) II, III, and IV D) I and II only

132.

Match the leaf modifications in Column-I with their functions/examples in Column-II:

Column-I (Leaf Part/Modification)	Column-II (Example/Function)
A. Pulvinus	1. Defense mechanism (<i>Cactus</i>)
B. Spines	2. Swollen leaf base in legumes (<i>Pea, Bean</i>)
C. Tendril	3. Photosynthetic expanded petiole (<i>Australian acacia</i>)
D. Phyllode	4. Climbing structure (<i>Pea</i>)

A) A-2, B-1, C-4, D-3

B) A-1, B-2, C-3, D-4

C) A-2, B-3, C-4, D-1

D) A-4, B-1, C-2, D-3

133.

Assertion (A): In *Calotropis*, the aestivation of sepals/petals is described as valvate.

Reason (R): Sepals or petals in a whorl just touch one another at the margin, without overlapping

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.

134.

Select the INCORRECT statement among the following:

A) In pinnately compound leaves, a number of leaflets are present on a common axis called the rachis.

B) In palmately compound leaves, leaflets are attached at a common point, i.e., at the tip of the petiole.

C) A bud is present in the axil of both simple and compound leaves, as well as in the axil of individual leaflets.

D) In alternate phyllotaxy, a single leaf arises at each node in an alternate manner.

135.

Monadelphous condition of stamens is characteristically observed in:

A) Pea

B) China rose

C) Citrus

D) Salvia

Zoology

136.

What is a group of individual belonging to the same species called-

A) Population

B) Biomes

C) Community

D) Family

137.

_____ links ecology to population genetics and evolution

A) Ecosystem

B) Biomes

C) Population ecology

D) Population attributes

138.

Population has certain attributes which are-

A) birth rates

B) death rates

C) sex ratio

D) All of these

139.

If the age distribution is plotted for the population, the resulting structure is called-

A) Population attributes

B) Population ecology

C) Age pyramids

D) None of these

140.

The tiger census in our national parks and tiger reserves is after based on-

A) Pug marks

B) Fecal pellets

C) Counting no. of tigers

D) Both A and B

141.

_____ is more meaningful measures of the population size of 200 parthenium and one Banyan tree

A) Total number

B) % cover or Biomass

C) Age

D) a and B

142.

The age distribution of a population is determined by:

A) Timing of birth

B) Timing of death

C) The rate at which the population is growing

D) All are correct

143.

What four factors define population growth?

- A) Birth, deaths, immigration, emigration B) Survivorship, age-specific mortality, fecundity, death rate
C) Mark-capture, census, sampling, transects D) Age-specific birth rates, Metapopulation structure, quad rate, ectone

144.

_____ contribute to an increase in population density

- A) Natality and emigration B) Mortality and emigration
C) Mortality and Immigration D) Natality and Immigration

145.

_____ refers to the no. of deaths in the population during a period

- A) Natality B) Immigration
C) Mortality D) Birth rate

146.

If N is the population density at time t, then its density at time t + 1 is

- A) $N_{t+1} = N_t + (B + E) - (D + I)$ B) $N_{t+1} = N_t + (B + D) - (E + I)$
C) $N_{t+1} = N_t - (B + I) - (D + E)$ D) $N_{t+1} = N_t + (B + I) - (D + E)$

147.

A biologist studied the population of rates in a born. He found that average Natality was 260, average Mortality 250, Immigration 30 and emmigration 40. The net increase in population is

- A) 10 B) 0
C) 15 D) 20

148.

The formula for exponential population growth is

- A) $dt/dN = rN$ B) $dN/rN = dt$
C) $rN/dN = dt$ D) $dN/dt = rN$

149.

Which of the following is not a factor that would limit the growth of population?

- A) Food shortage B) Immigration
C) Disease D) Famine

150.

Darwinian fitness is represented by

- A) Low r value B) High r value
C) High k value D) Low k value

151.

Carrying capacity is denoted as

- A) r B) N
C) K D) I

152.

Figure For calculation of the r value, which of the following is required?

- A) Birth rates B) Death rates
C) Both a and b D) None

153.

Which of the following equation is correct for Logistic growth?

- A) $N_t = N_{0e^{rt}}$ B) $dN/dt = rN$
C) $dt/dN = rN (K-N/K)$ D) $dN/dt = rN (K-N/K)$

154.

_____ refers to the no. of births during a given period in the population that are added to the initial density.

- A) Natality B) Mortality
C) Immigration D) Survival

155.

Logistic curve is _____.

- A) L-shaped B) J-shaped
C) Sigmoid curve D) None of these

156.

A plot of N in relation to time (t) results in sigmoid curve. This type of population growth is called

- A) J shaped Curve B) U shaped Curve
C) Verhulst-Pearl Logistic Growth D) Constant Growth

157.

Which growth model is considered as more realistic one?

- A) Exponential growth B) Constant growth
C) Logistic growth D) None of these

158.

A population growing in a habitat with limited resources show initially a __A__ followed by phase of __B__ and finally __C__.

- A) A-Lag phase, B-Acceleration and deceleration, C-an asymptote
B) A-Log phase, B-Acceleration and deceleration, C-an asymptote
C) A-Log phase, B-Acceleration and deceleration, C-a symptote
D) A-Log phase, B-Acceleration and deceleration, C-a symptote

159.

To calculate the current r value for human population we need to know about

- A) Birth rate
B) Death rate
C) Carrying capacity
D) Both A and B

160.

Human population follows the _____ as the carrying capacity increase or we do not meet yet our population carrying capacity.

- A) J-shaped growth curve
B) Z-shaped growth curve
C) S-shaped growth curve
D) All of the above

161.

Which of the following organism breeds only once on their life time?

- A) Pacific salmon fish
B) Oyester
C) Bamboo
D) Both A and C

162.

Which of the following organism produces a large no. of small sized offspring?

- A) Pacific salmon fish
B) Oyester and pelagic fishes
C) Oyester and pacific salmon fish
D) Birds and mammals

163.

The natural selection operates at

- A) organism level
B) Population level
C) organ level
D) ecosystem level

164.

Which of the following attribute is possessed by a population but not by an individual organism?

- A) birth rate
B) death rate
C) sex ratio
D) all of these

165.

Of the number of pre reproductive individuals are much higher than the number of reproductive and post reproductive individuals, the population will be

- A) expanding
B) declining
C) stable
D) none of these

166.

The number of deaths in the population during a given period is known as

- A) Natality
B) mortality
C) sex ratio
D) diapause

167.

Select the correct option

- A) $N_{t+1} = N_t + [(B + D) - (I + E)]$
B) $N_{t+1} = N_t + [(B + E) - (I + D)]$
C) $N_{t+1} = N_t + [(B + I) - (D + E)]$
D) $N_{t+1} = N_t + [(B + I) - (D - E)]$

168.

The 'r' value for human population in India in 1981 was

- A) 0.15
B) 0.0015
C) 0.0205
D) 1.05

169.

The Verhulst Pearl logistic growth results in

- A) sigmoid curve
B) J-shaped curve
C) hyperbolic curve
D) all of these

170.

The age of pyramid with broad base indicates

- A) high percentage of young individuals
B) low percentage of young individuals
C) high percentage of old individuals
D) low percentage of old individual

171.

Logistic growth formula is :-

- A) $\frac{dN}{dt} = rN$
B) $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$
C) $\frac{dN}{dt} = rN \left(\frac{N-K}{N} \right)$
D) $\frac{dN}{dt} = N^r$

172.

If in a pond there are 20 lotus plants of last year and through reproduction 8 new plants are added. Then the birth rate is

- A) 0.8 offspring per lotus per year
B) 0.2 offspring per lotus per year
C) 0.4 offspring per lotus per year
D) 0.6 offspring per lotus per year

173.

Individuals alive at the beginning of 1 year to 2 years age interval is 800. During this interval 200 individual die. Then find out the death rate.

- A) 200 B) 800
C) 0.4 D) 0.25

174.

If birth rate is 100, death rate is 10 and number of individuals in population group is 1000, then what will be the percentage of natural growth rate?

- A) 0.09% B) 9.0%
C) 0.9% D) 90%

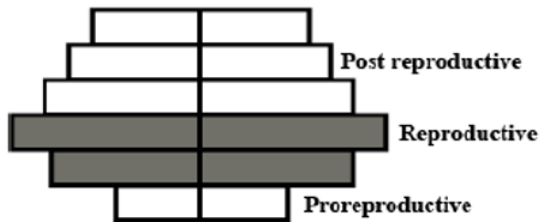
175.

If $b = 65$ and $d = 45$, $N = 100$ then find out dN / dt

- A) 2000 B) 1000
C) 200 D) 100

176.

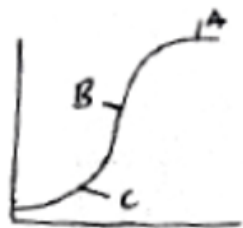
What type of human population is represented by the following are pyramid?



- A) Stable population B) Declining population
C) Expanding population D) Vanishing population

177.

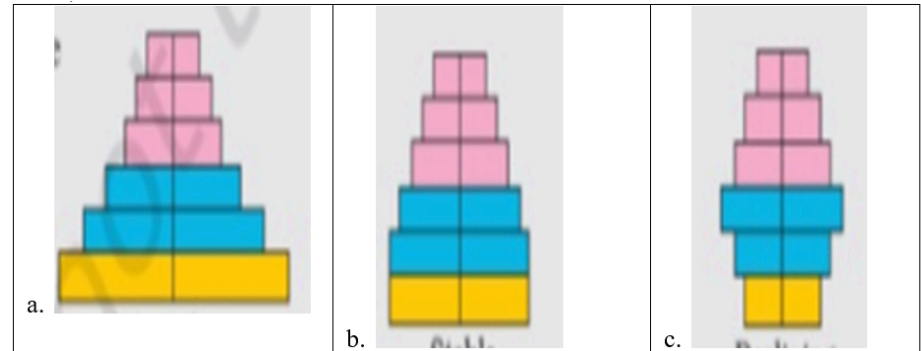
What are Labelled phase A, B and C in given sigmoid growth curve?



- A) A-Lag, B-Log, C-Stationary B) A-Stationary, B-Log, C-Lag
C) A-Lag, B-Stationary, C-Log D) A-Stationary, B-Lag, C-Log

178.

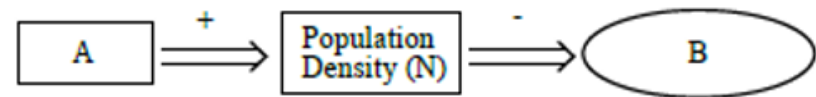
Age pyramid A, B and C indicates.



- A) A-Expanding population, B-Stable population, C-Declining population
B) A-Expanding population, B-Declining population, C-Stable population
C) A- Stable population, B-Declining population, C- Expanding population
D) A-Declining population, B-Stable population, C-Expanding population,

179.

Fill up A and B Boxes in the given diagram with correct options:



- A) A = Natality + Immigration, B = Mortality + Emigration
B) A = Natality + Mortality, B = Immigration + Emigration
C) A = Birth rate + Death rate, B = Migration + Emigration
D) A = Natality + Emigration, B = Mortality + Immigration

180.

Birth rate = B, Death rate = D, Emigration = E and Immigration = I

Column I		Column II	
a	Population is increasing	i	$B + I = D + E$
b	Population is decreasing	ii	$B + I < D + E$
c	Population is stable	iii	$B + I > D + E$

- A) a-iii, b-ii, c-i
B) a-ii, b-iii, c-i
C) a-i, b-ii, c-iii
D) a-ii, b-i, c-iii

ANSWER KEY

Physics

1.	3	13.	3	25.	2	37.	2
2.	3	14.	2	26.	3	38.	2
3.	2	15.	2	27.	1	39.	1
4.	3	16.	2	28.	1	40.	2
5.	2	17.	2	29.	1	41.	1
6.	3	18.	2	30.	1	42.	2
7.	3	19.	1	31.	1	43.	2
8.	3	20.	2	32.	1	44.	3
9.	4	21.	2	33.	1	45.	2
10.	1	22.	3	34.	1		
11.	3	23.	3	35.	1		
12.	3	24.	2	36.	1		

Chemistry

46.	4	58.	1	70.	3	82.	3
47.	1	59.	2	71.	3	83.	3
48.	1	60.	1	72.	4	84.	2
49.	3	61.	2	73.	1	85.	3
50.	2	62.	3	74.	1	86.	1
51.	1	63.	4	75.	1	87.	2
52.	3	64.	3	76.	1	88.	1
53.	1	65.	4	77.	4	89.	4
54.	1	66.	1	78.	1	90.	1
55.	4	67.	3	79.	4		
56.	2	68.	1	80.	1		
57.	3	69.	1	81.	4		

Botany

91.	3	94.	2	97.	3	100.	2
92.	3	95.	3	98.	2	101.	3
93.	1	96.	2	99.	3	102.	1

103.	3	112.	3	121.	2	130.	1
104.	2	113.	4	122.	4	131.	1
105.	3	114.	2	123.	3	132.	1
106.	2	115.	1	124.	3	133.	1
107.	1	116.	1	125.	1	134.	3
108.	2	117.	3	126.	2	135.	2
109.	1	118.	2	127.	3		
110.	2	119.	2	128.	1		
111.	3	120.	2	129.	1		

Zoology.

136.	1	148.	4	160.	1	172.	3
137.	3	149.	2	161.	4	173.	4
138.	4	150.	2	162.	2	174.	2
139.	3	151.	3	163.	2	175.	1
140.	1	152.	3	164.	4	176.	2
141.	4	153.	4	165.	1	177.	2
142.	2	154.	1	166.	2	178.	1
143.	1	155.	3	167.	3	179.	1
144.	4	156.	3	168.	3	180.	1
145.	3	157.	3	169.	1		
146.	4	158.	1	170.	1		
147.	2	159.	4	171.	4		

SOLUTIONS

Q1.

Answer: C

Explanation:

For an inextensible rope, the total change in rope length is zero. The two horizontal portions decrease due to the motion of the blocks, while the two vertical portions increase due to the downward motion of the movable pulley. Therefore, $-a_1 - a_2 + 2a_3 = 0$ $2a_3 = a_1 + a_2$ $a_3 = \frac{8+4}{2} = 6m/s^2$

Q2.

Answer: C

Explanation:

Using the constant-length condition of the rope, $-a_1 - a_2 + 2a_3 = 0$ Therefore, $a_3 = \frac{a_1+a_2}{2}$
 $a_3 = \frac{10+2}{2} = 6m/s^2$

Q3.

Answer: B

Explanation:

For the inextensible string, $-a_1 + a_2 + 2a' = 0$ Substituting, $-4 + 10 + 2a' = 0$ $2a' = -6$ Thus, the central pulley accelerates upwards with magnitude $a' = 3m/s^2$

Q4.

Answer: C

Explanation:

Using the string constraint, $-a_1 + a_2 + 2a' = 0$ Substituting, $-6 + 14 + 2a' = 0$ $2a' = -8$
Therefore, the central pulley accelerates upward with magnitude $a' = 4m/s^2$

Q5.

Answer: B

Explanation:

For the movable pulley, the acceleration constraint is $2Ta' = Ta$ Therefore, $2a' = a$ $a' = \frac{a}{2}$
 $a' = \frac{6}{2} = 3m/s^2$

Q6.

Answer: C

Explanation:

For the movable pulley, $2Ta' = Ta$ Hence, $2a' = a$ Therefore, $a' = \frac{a}{2}$ $a' = \frac{10}{2} = 5m/s^2$

Q7.

Answer: C

Explanation:

For the movable pulley, the displacement of block 1 is twice the displacement of block 2. Therefore,
 $a_1 = 2a_2$ $a_2 = \frac{a_1}{2}$ $a_2 = \frac{6}{2} = 3m/s^2$

Q8.

Answer: C

Explanation:

The movable pulley gives the constraint $a_1 = 2a_2$ Hence, $a_2 = \frac{a_1}{2}$ $a_2 = \frac{10}{2} = 5m/s^2$

Q9.

Answer: D

Explanation:

Taking downward direction as positive, the string constraint is $-a_1 - 2a_2 + 2a_3 + a' = 0$ Substituting the values, $-4 - 2(2) + 2(6) + a' = 0$ $-4 - 4 + 12 + a' = 0$ $a' = -4m/s^2$ The negative sign means the third/right block moves upwards. Thus, $|a'| = 4m/s^2$

Q10.

Answer: A

Explanation:

Taking downward as positive, $-a_1 - 2a_2 + 2a_3 + a' = 0$ Substituting, $-3 - 2(4) + 2(5) + a' = 0$
 $-3 - 8 + 10 + a' = 0$ $a' = 1m/s^2$ Therefore, the correct answer is actually none of the above. To make the question valid, the options should include $1m/s^2$.

Q11.

Answer: C

Explanation:

The movable pulley and the green platform move together. Therefore, three segments of the string change their lengths due to the downward motion of the platform. Hence, $a_1 = 3a'$ $a' = \frac{a_1}{3}$
 $a' = \frac{9}{3} = 3m/s^2$

Q12.

Answer: C

Explanation:

Since three portions of the string effectively lengthen when the platform moves downward, $a_1 = 3a'$
Therefore, $a' = \frac{a_1}{3}$ $a' = \frac{12}{3} = 4m/s^2$

Q13.

Answer: C

Explanation:

For the given string-pulley arrangement, the acceleration constraint is $2a_1 + a_2 + 3a_3 = 0$
Substituting the values, $2(3) + 6 + 3a_3 = 0$ $12 + 3a_3 = 0$ $a_3 = -4m/s^2$

Q14.

Answer: B

Explanation:

Using the string constraint, $2a_1 + a_2 + 3a_3 = 0$ Substitute the given values: $2(5) + 4 + 3a_3 = 0$
 $14 + 3a_3 = 0$ Therefore, $a_3 = -\frac{14}{3}m/s^2$

Q15.

Answer: B

Explanation:

Using the string constraint, the component of a_1 along the inclined string equals a_2 . $a_2 = a_1 \cos 37^\circ$
Using $\cos 37^\circ = \frac{4}{5}$, $a_2 = 15 \times \frac{4}{5} = 12m/s^2$

Q16.

Answer: B

Explanation:

The string constraint gives $a_2 = a_1 \cos 60^\circ$ Since $\cos 60^\circ = \frac{1}{2}$ we get $a_2 = 20 \times \frac{1}{2} = 10m/s^2$

Q17.

Answer: B

Explanation:

The acceleration of the hanging block is the component of the ring's acceleration along the string.
 $a_2 = a_1 \cos 37^\circ$ Using $\cos 37^\circ = \frac{4}{5}$, $a_2 = 15 \times \frac{4}{5} = 12m/s^2$

Q18.

Answer: B

Explanation:

The acceleration along the string is $a_2 = a_1 \cos 60^\circ$ Since $\cos 60^\circ = \frac{1}{2}$, $a_2 = 20 \times \frac{1}{2} = 10m/s^2$

Q19.

Answer: A

Explanation:

Using the constant-length condition of the string, $V_0 = V_B + V_B \cos 60^\circ$ Therefore, $V_B = \frac{V_0}{1 + \cos 60^\circ}$

Q20.

Answer: B

Explanation:

The component of the velocity of B along the inclined string is $V_B \cos 37^\circ$ The string-length constraint gives $2V_0 = V_B + V_B \cos 37^\circ$ Hence, $V_B = \frac{2V_0}{1 + \cos 37^\circ}$

Q21.

Answer: B

Explanation:

For the given arrangement, the string-length constraint is $a_1 + a_2 + 2a_3 = 0$ Substituting,
 $4 + 2 + 2a_3 = 0$ $2a_3 = -6$ Therefore, $a_3 = -3m/s^2$

Q22.

Answer: C

Explanation:

Using the string constraint, $a_1 + a_2 + 2a_3 = 0$ Substituting, $6 + 3 + 2a_3 = 0$ $2a_3 = -9$ Therefore,
 $a_3 = -\frac{9}{2}m/s^2$ This does not match the listed options, so the options need correction. Correct value:
 $-\frac{9}{2}m/s^2$

Q23.

Answer: C

Explanation:

The platform is connected to four variable string segments. Therefore, $4a = a_1 + a'$ Hence,
 $a' = 4a - a_1$ $a' = 4(5) - 8$ $a' = 12m/s^2$

Q24.

Answer: B

Explanation:

For the given pulley arrangement, $4a = a_1 + a'$ Therefore, $a' = 4a - a_1$ $a' = 4(7) - 10$
 $a' = 18m/s^2$

Q25.

Answer: B

Explanation:

Using the string-length constraints successively, $2a_3 = a'$ and $2a_2 = a' + a_p$ where a_p is the acceleration of the upper-left movable pulley. For the upper string, $a_1 + a_2 = 2a_p$ Substituting the given values gives $a' = 8m/s^2$

Q26.

Answer: C

Explanation:

For the lowest movable pulley, the string constraint is $2a_3 = a'$ Given $a_3 = 5m/s^2$ Therefore,
 $a' = 2(5) = 10m/s^2$

Q27.

Answer: A

Explanation:

For the movable pulley, $a_2 = 2a_1$ For the 10kg block: $100 - 2T = 10a_1$ For the 3kg block:
 $T - 30 = 3a_2$ Using $a_2 = 2a_1$: $T - 30 = 6a_1$ Hence, $100 - 2(30 + 6a_1) = 10a_1$ $40 = 22a_1$
Therefore, $a_1 = \frac{20}{11}m/s^2$ and $a_2 = 2a_1 = \frac{40}{11}m/s^2$.

Q28.

Answer: A

Explanation:

The pulley constraint gives $a_2 = 2a_1$ For the 15kg block: $150 - 2T = 15a_1$ For the 4kg block:
 $T - 40 = 4a_2$ Using $a_2 = 2a_1$: $T = 40 + 8a_1$ Therefore, $150 - 2(40 + 8a_1) = 15a_1$ $70 = 31a_1$
Hence, $a_1 = \frac{70}{31}m/s^2$ and $a_2 = \frac{140}{31}m/s^2$.

Q29.

Answer: A

Explanation:

The string constraints give $a_2 = -2a_1$ For the 2kg block: $2T - 20 = 2a_1$ For the 5kg block:
 $T - 50 = 5a_2$ Using $a_2 = -2a_1$: $T = 50 - 10a_1$ Therefore, $2(50 - 10a_1) - 20 = 2a_1$ $80 = 22a_1$
Hence, $a_1 = \frac{40}{11}m/s^2$ and $a_2 = -\frac{80}{11}m/s^2$.

Q30.

Answer: A

Explanation:

The acceleration constraint is $a_2 = -2a_1$ For the 6kg block: $2T - 60 = 6a_1$ For the 8kg block:
 $T - 80 = 8a_2$ Using $a_2 = -2a_1$: $T = 80 - 16a_1$ Therefore, $2(80 - 16a_1) - 60 = 6a_1$
 $100 = 38a_1$ Hence, $a_1 = \frac{50}{19}m/s^2$ and $a_2 = -\frac{100}{19}m/s^2$.

Q31.

Answer: A

Explanation:

From the string-length constraint, $a_2 = -3a_1$ For the 4kg block: $T - 40 = 4a_2$ For the 10kg block:
 $3T - 100 = 10a_1$ Using $a_2 = -3a_1$, $T - 40 = -12a_1$ $T = 40 - 12a_1$ Therefore,
 $3(40 - 12a_1) - 100 = 10a_1$ $20 = 46a_1$ Hence, $a_1 = \frac{10}{23}m/s^2$ and $a_2 = -\frac{30}{23}m/s^2$.

Q32.

Answer: A

Explanation:

The constraint is $a_2 = -3a_1$ For the 5kg block: $T - 50 = 5a_2$ For the 12kg block:
 $3T - 120 = 12a_1$ Using $a_2 = -3a_1$, $T = 50 - 15a_1$ Therefore, $3(50 - 15a_1) - 120 = 12a_1$
 $30 = 57a_1$ Thus, $a_1 = \frac{10}{19}m/s^2$ and $a_2 = -\frac{30}{19}m/s^2$.

Q33.

Answer: A

Explanation:

Since all four masses are scaled by the same factor compared with the standard 2 : 4 : 8 : 16 system,
the acceleration values remain unchanged. For the 3kg block: $2T - 30 = 3a_1$ For the 6kg block:
 $4T - 60 = 6a_2$ For the 12kg block: $T - 120 = 12a_3$ For the 24kg block: $T - 240 = 24a_4$ The
pulley constraints give the corresponding acceleration relations. Solving simultaneously gives
 $T = \frac{640}{33}N$ and therefore $a_1 = a_2 = \frac{290}{99}m/s^2$ $a_3 = -\frac{830}{99}m/s^2$ $a_4 = -\frac{910}{99}m/s^2$

Q34.

Answer: A

Explanation:

The four masses have the same ratio 5 : 10 : 20 : 40 = 2 : 4 : 8 : 16 as the original system.
Therefore, the common scaling of all masses does not change the accelerations. For the 5kg block:
 $2T - 50 = 5a_1$ For the 10kg block: $4T - 100 = 10a_2$ For the 20kg block: $T - 200 = 20a_3$ For the
40kg block: $T - 400 = 40a_4$ Solving with the pulley constraints gives $a_1 = a_2 = \frac{290}{99}m/s^2$
 $a_3 = -\frac{830}{99}m/s^2$ $a_4 = -\frac{910}{99}m/s^2$

Q35.

Answer: A

Explanation:

For the 2kg block: $2T - 20 = 2a_1$ For the 3kg block: $T - 30 = 3a_2$ For the 4kg block:
 $T - 40 = 4a_3$ The string constraints give $a_2 + a_3 = -2a_1$ Solving, $T = \frac{480}{31}N$ Therefore,
 $a_1 = \frac{170}{31}m/s^2$ $a_2 = -\frac{150}{31}m/s^2$ $a_3 = -\frac{190}{31}m/s^2$

Q36.

Answer: A

Explanation:

For the 3kg block: $2T - 30 = 3a_1$ For the 4kg block: $T - 40 = 4a_2$ For the 5kg block:
 $T - 50 = 5a_3$ The kinematic constraint is $a_2 + a_3 = -2a_1$ Solving gives $T = \frac{2400}{107}N$. Hence,
 $a_1 = \frac{530}{107}m/s^2$ $a_2 = -\frac{470}{107}m/s^2$ $a_3 = -\frac{590}{107}m/s^2$

Q37.

Answer: B

Explanation:

For the horizontal block: $3ma = 2T$ For the hanging block: $mg - T = ma_1$ The string constraint gives: $a_1 = 2a$ Thus, $mg - T = 6T/3 = 2T$ $mg = 3T$ $T = \frac{mg}{3}$ Therefore, $a_1 = \frac{2T}{3m} \times 2 = \frac{4g}{7}$

Q38.

Answer: B

Explanation:

For the horizontal block: $3ma = 2T$ The constraint is: $a_1 = 2a$ For the hanging $2m$ block: $2mg - T = 2ma_1$ Using $a_1 = 2a$, $2mg - T = 4ma$ Since $3ma = 2T$, $2mg - T = \frac{8T}{3}$ Hence, $T = \frac{6mg}{11}$ and $a_1 = \frac{8g}{11}$.

Q39.

Answer: A

Explanation:

For the m block: $T - mg \sin 37^\circ = ma_1$ $T - \frac{3mg}{5} = ma_1$ For the $2m$ block: $2T - 2mg = 2ma_2$ $T - mg = ma_2$ The string constraint is $a_1 + 2a_2 = 0$ Therefore, $a_1 = \frac{4g}{15}$, $a_2 = -\frac{2g}{15}$

Q40.

Answer: B

Explanation:

For the m block: $T - \frac{4mg}{5} = ma_1$ For the $2m$ block: $T - mg = ma_2$ The constraint is $a_1 = -2a_2$ Equating the two expressions for T : $a_1 + \frac{4g}{5} = a_2 + g$ Therefore, $a_1 - a_2 = \frac{g}{5}$ Using $a_1 = -2a_2$: $-3a_2 = \frac{g}{5}$ Thus, $a_2 = -\frac{g}{15}$ and $a_1 = \frac{2g}{15}$.

Q41.

Answer: A

Explanation:

The mass ratio remains $4m : 8m : 2m = 2 : 4 : 1$ compared with the original system. Since all masses are doubled while F remains unchanged, the acceleration is halved: $a_B = \frac{1}{2} \left(\frac{F}{7m} \right)$ Therefore, $a_B = \frac{F}{14m}$

Q42.

Answer: B

Explanation:

The mass ratio is $3m : 6m : \frac{3m}{2} = 2 : 4 : 1$ The new masses are $\frac{3}{2}$ times the original masses. Thus, for the same force, $a_B = \frac{1}{3/2} \left(\frac{F}{7m} \right) = \frac{2F}{21m}$ Therefore, $a_B = \frac{2F}{21m}$

Q43.

Answer: B

Explanation:

$v_A = -6$, $v_B = 3$, $v_C = -2$ First string: $v_A + 2v_P = 0 \Rightarrow v_P = 3\text{m/s}$ Second string: $v_B + v_Q - 2v_P = 0 \Rightarrow v_Q = 3\text{m/s}$ Third string: $v_C + v_E - 2v_Q = 0 \Rightarrow v_E = 8\text{m/s}$. Therefore, $v_E = 8\text{m/s}$ upward.

Q44.

Answer: C

Explanation:

$v_A = -10$, $v_B = 4$, $v_C = -3$ First string: $v_A + 2v_P = 0 \Rightarrow v_P = 5\text{m/s}$ Second string: $v_B + v_Q - 2v_P = 0 \Rightarrow v_Q = 6\text{m/s}$ Third string: $v_C + v_E - 2v_Q = 0 \Rightarrow v_E = 15\text{m/s}$. Hence, $v_E = 15\text{m/s}$ upward.

Q45.

Answer: B

Explanation:

Take upward as positive: $v_A = -8$, $v_B = +2$, $v_C = -1$ For the three strings: $v_A + 2v_P = 0$ $v_B + v_Q - 2v_P = 0$ $v_C + v_E - 2v_Q = 0$ Thus, $v_P = 4\text{m/s}$, $v_Q = 6\text{m/s}$, and $v_E = 13\text{m/s}$ upward.

Q46.

Answer: D

Explanation:

At N.T.P., 22400 cc of any gas contains 6.02×10^{23} molecules. Evaluating the number of molecules, total atoms (3 per molecule), and total electrons (22per molecule) in 1 cc confirms that options A, B, and C are all correct expressions.

Q47.

Answer: A

Explanation:

The density of a gas at S.T.P. is determined by dividing its molar mass by the molar volume (22.4 L) at S.T.P.

Q48.

Answer: A

Explanation:

One mole of CO_2 (44 g) contains $2 \times N_A$ oxygen atoms. Thus, 4.4 g (0.1 mol) contains $0.2 \times 6.02 \times 10^{23} = 1.2 \times 10^{23}$ oxygen atoms.

Q49.

Answer: C

Explanation:

According to Avogadro's Law, equal volumes of all gases under identical conditions of temperature and pressure contain equal numbers of molecules. Therefore, 2 L of SO_2 contains twice as many molecules as 1 L of O_2 .

Q50.

Answer: B

Explanation:

6.02×10^{24} molecules of CO represent 10 moles (10 g-atoms) of oxygen atoms. Since O_2 is diatomic, 10 g-atoms of oxygen equal 5 g-molecules of O_2 .

Q51.

Answer: A

Explanation:

A 5 M H_2SO_4 solution has a normality of 10 N (since $N = M \times \text{basicity}$). Diluting 10 N from 1 L to 10 L gives a final normality of 1 N using $N_1 V_1 = N_2 V_2$.

Q52.

Answer: C

Explanation:

The formula mass of N_3^- is 42 g mol⁻¹, so 4.2 g contains 0.1 mol of ions. Each N_3^- ion has 16 valence electrons ($3 \times 5 + 1$), giving $0.1 \times 16N_A = 1.6N_A$ total valence electrons.

Q53.

Answer: A

Explanation:

One litre (1000 mL) of air contains 210 mL of O_2 . Dividing 210 mL by the molar volume at standard conditions (22400 mL mol⁻¹) gives 0.0093 mol.

Q54.

Answer: A

Explanation:

The mass of iron in one molecule of haemoglobin is $\frac{0.334}{100} \times 67200 = 224.45$ amu. Dividing by the atomic weight of iron (56) gives approximately 4 iron atoms.

Q55.

Answer: D

Explanation:

4.25 g of NH_3 corresponds to 0.25 mol of NH_3 molecules (1.5×10^{23} molecules). Since each NH_3 molecule has 4 atoms, the total number of atoms is $4 \times 1.505 \times 10^{23} \approx 6.023 \times 10^{23}$.

Q56.

Answer: B

Q57.

Answer: C

Q58.

Answer: A

Q59.

Answer: B

Q60.

Answer: A

Q61.

Answer: B

Explanation:

Number of atoms equals Moles $\times N_A \times \text{Atomicity}$. For 0.1 mol of a triatomic gas, Atoms = $0.1 \times 6.023 \times 10^{23} \times 3 = 1.806 \times 10^{23}$.

Q62.

Answer: C

Explanation:

Comparing mole quantities: 44 g $CO_2 = 1$ mol, 48 g $O_3 = 1$ mol, 64 g $SO_2 = 1$ mol, whereas 8 g $H_2 = 4$ mol ($4N_A$ molecules), which is maximum.

Q63.

Answer: D

Explanation:

6.02×10^{20} molecules equal 10^{-3} moles. Dividing by volume in litres (0.1 L) yields a molarity of $\frac{10^{-3}}{0.1} = 0.01$ M.

Q64.

Answer: C

Explanation:

By Avogadro's hypothesis, gas volume ratios equal mole ratios. For equal mass w , mole ratio is $\frac{w}{2} : \frac{w}{32} : \frac{w}{16}$, which simplifies to 16 : 1 : 2.

Q65.

Answer: D

Explanation:

Moles of $H_2 = \frac{1}{2}$ and moles of $O_2 = \frac{4}{32} = \frac{1}{8}$. The molar ratio $n_{H_2} : n_{O_2} = \frac{1}{2} : \frac{1}{8} = 4 : 1$.

Q66.

Answer: A

Explanation:

One mole is defined as the mass of N_A atoms of carbon-12. Changing N_A directly changes the mass of 1 mole of carbon from 12 g to 12×10^{-3} g.

Q67.

Answer: C

Explanation:

Evaluating molecule counts: 1.8 g = $0.1N_A$, 18 g = $1N_A$, 18 moles = $18N_A$, and 18 molecules = 18. 18 moles of water contains the maximum number of molecules.

Q68.

Answer: A

Explanation:

Setting up molar mass equations $x + 2y = 100$ and $3x + 2y = 180$ gives $2x = 80 \implies x = 40$ and $y = 30$.

Q69.

Answer: A

Explanation:

18 mL of water has a mass of 18 g (density = 1 g/mL), representing 1 mol ($1N_A$ molecules), which is larger than options B ($10^{-2}N_A$), C ($10^{-4}N_A$), and D ($10^{-3}N_A$).

Q70.

Answer: C

Q71.

Answer: C

Explanation:

Atoms = $\frac{\text{Mass}}{\text{Molar Mass}} \times N_A \times \text{Atomicity}$. Comparing values: Mg ($\frac{N_A}{24}$), O_2 ($\frac{N_A}{16}$), Li ($\frac{N_A}{7}$), Ag ($\frac{N_A}{108}$) shows 1 g of Li has the maximum number of atoms.

Q72.

Answer: D

Explanation:

Using $m = \frac{1000 \times M}{1000 \times d - M \times M_w}$, substituting $M = 1$, $d = 1.25$, and $M_w = 85$ gives $\frac{1000}{1250 - 85} = \frac{1000}{1165} = 0.858$ m.

Q73.

Answer: A

Explanation:

4 mol of He contains $4N_A$ atoms. By comparison, 4 u equals 1 atom, 4 g equals $1N_A$ atoms, and 2.271098 L equals $0.1N_A$ atoms.

Q74.

Answer: A

Explanation:

Moles of 1.0 g $H_2 = \frac{1}{2} = 0.5$ mol ($0.5N_A$ molecules). 14 g of N_2 equals $\frac{14}{28} = 0.5$ mol ($0.5N_A$ molecules), having the exact same molecule count.

Q75.

Answer: A

Explanation:

Using $M = \frac{w \times 1000}{M_w \times V(\text{mL})}$, substituting $M = \frac{1}{20}$, $M_w = 180$, and $V = 250$ mL gives $w = \frac{180 \times 250}{20 \times 1000} = 2.25$ g.

Q76.

Answer: A

Explanation:

Calculating the mass of 1 L solution from density and multiplying by 70% purity gives 1078 g of pure H_3PO_4 . Dividing by its molar mass (98 g mol^{-1}) yields 11 moles in 1 L, which equals 11 M.

Q77.

Answer: D

Explanation:

In 1000 mL of solution (mass 1000 g), 3 moles of NaCl weigh 175.5 g. The mass of solvent is 824.5 g, giving a molality of $\frac{3}{0.8245} \approx 3.64$ m = 364×10^{-2} m.

Q78.

Answer: A

Explanation:

Dividing the volume 2.8375 L by the molar volume at STP (22.7 L mol^{-1}) gives 0.125 moles. Multiplying by Avogadro's number gives 7.527×10^{22} molecules.

Q79.

Answer: D

Explanation:

Hydrated oxalic acid ($H_2C_2O_4 \cdot 2H_2O$) has a molar mass of 126 g mol^{-1} . Dissolving 3.15 g (0.025 mol) in 250 mL yields 0.1 M solution, making R the factual explanation for A.

Q80.

Answer: A

Explanation:

16 g $CH_4 = 1$ mol ($60.2 \times 10^{23} \text{ e}^-$). 1 g $H_2 = 0.5$ mol (11.4 L at STP). 1 mol $N_2 = 28$ g. 0.5 mol $SO_2 = 32$ g.

Q81.

Answer: D

Explanation:

One mole of water weighs 18 g. Adding 2 g of solute X gives a total solution mass of 20 g. Mass percentage of X is $\frac{2}{20} \times 100 = 10\%$.

Q82.

Answer: C

Explanation:

In 100 g solution (35 g HCl), volume is $\frac{100}{1.46}$ mL = $\frac{100}{1.46 \times 1000}$ L. Moles of $HCl = \frac{35}{36.5}$. Molarity $M = \frac{35/36.5}{100/1460} = 14.0$ M.

Q83.

Answer: C

Explanation:

Mass of iron in 3.3 g hemoglobin is $\frac{0.34}{100} \times 3.3$ g. Dividing by 56 g mol^{-1} and multiplying by N_A gives 1.21×10^{20} atoms.

Q84.

Answer: B

Explanation:

10.8% carbon in 250 g solution equals 27 g carbon. Since glucose ($C_6H_{12}O_6$) has 72 g carbon per mole (180 g), this corresponds to 0.375 mol glucose (67.5 g). Solvent mass is 182.5 g, giving $m \approx 2.06$ m.

Q85.

Answer: C

Explanation:

100 mL of 0.1 M H_2SO_4 provides 20 meq. 50 mL of 0.1 M $NaOH$ provides 5 meq. Remaining H_2SO_4 is 15 meq in 150 mL, giving 0.1 N = 1×10^{-1} N.

Q86.

Answer: A

Explanation:

100 molal solution has 100 moles solute in 1000 g (55.55 moles) water. Mole fraction $\chi = \frac{100}{100+55.55} = 0.643 = 64.3 \times 10^{-2} \approx 64 \times 10^{-2}$.

Q87.

Answer: B

Explanation:

Moles of $Na = \frac{8}{23} = 0.3478$ mol. Number of atoms = $0.3478 \times 6.022 \times 10^{23} = 2.09 \times 10^{23} \approx 2 \times 10^{23}$.

Q88.

Answer: A

Explanation:

100 g solution (63 g $HNO_3 = 1$ mol) has volume $\frac{100}{1.4}$ mL = 71.4 mL. Molarity $M = \frac{1 \text{ mol}}{0.0714 \text{ L}} = 14$ M.

Q89.

Answer: D

Explanation:

Mass of 1 L sea water is 1030 g. Mass of O_2 is 10.30×10^{-3} g. Concentration in ppm = $\frac{10.30 \times 10^{-3}}{1030} \times 10^6 = 10$.

Q90.

Answer: A

Explanation:

Assume total moles of solution = 1 mol. Then moles of glucose = 0.1 mol and moles of water = 0.9 mol. Calculate their masses and then determine the mass percentage of water.

Q91.

Answer: C

Q92.

Answer: C

Q93.

Answer: A

Q94.

Answer: B

Q95.

Answer: C

Q96.

Answer: B

Q97.

Answer: C

Q98.

Answer: B

Q99.

Answer: C

Q100.

Answer: B

Q101.

Answer: C

Q102.

Answer: A

Q103.

Answer: C

Q104.

Answer: B

Q105.

Answer: C

Q106.

Answer: B

Q107.

Answer: A

Q108.

Answer: B

Q109.

Answer: A

Q110.

Answer: B

Q111.

Answer: C

Q112.

Answer: C

Q113.

Answer: D

Q114.

Answer: B

Q115.

Answer: A

Q116.

Answer: A

Q117.

Answer: C

Q118.

Answer: B

Q119.

Answer: B

Q120.

Answer: B

Q121.

Answer: B

Q122.

Answer: D

Q123.

Answer: C

Q124.

Answer: C

Q125.

Answer: A

Q126.

Answer: B

Q127.

Answer: C

Q128.

Answer: A

Q129.

Answer: A

Q130.

Answer: A

Q131.

Answer: A

Q132.

Answer: A

Q133.

Answer: A

Q134.

Answer: C

Q135.

Answer: B

Q136.

Answer: A

Q137.

Answer: C

Q138.

Answer: D

Q139.

Answer: C

Q140.

Answer: A

Q141.

Answer: D

Q142.

Answer: B

Q143.

Answer: A

Q144.

Answer: D

Q145.

Answer: C

Q146.

Answer: D

Q147.

Answer: B

Q148.

Answer: D

Q149.

Answer: B

Q150.

Answer: B

Q151.

Answer: C

Q152.

Answer: C

Q153.

Answer: D

Q154.

Answer: A

Q155.

Answer: C

Q156.

Answer: C

Q157.

Answer: C

Q158.

Answer: A

Q159.

Answer: D

Q160.

Answer: A

Q161.

Answer: D

Q162.

Answer: B

Q163.

Answer: B

Q164.

Answer: D

Q165.

Answer: A

Q166.

Answer: B

Q167.

Answer: C

Q168.

Answer: C

Q169.

Answer: A

Q170.

Answer: A

Q171.

Answer: D

Q172.

Answer: C

Q173.

Answer: D

Q174.

Answer: B

Q175.

Answer: A

Q176.

Answer: B

Q177.

Answer: B

Q178.

Answer: A

Q179.

Answer: A

Q180.

Answer: A