# KNOWLEDGE AREA: MECHANICS

## Answers

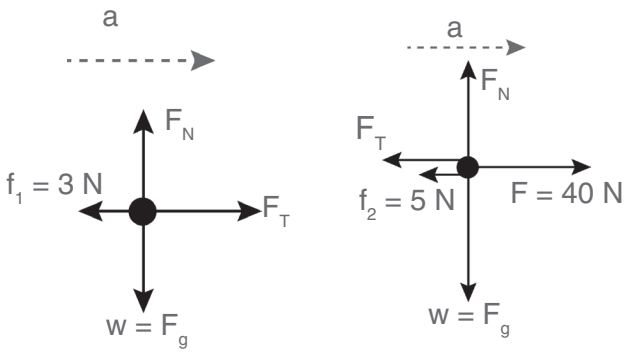
### Multiple-choice questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. | D | 2. | D | 3. | C | 4. | A | 5. | A |
| 6. | D | 7. | C | 8. | A | 9. | C | 10. | D |
| 11. | A | 12. | B | 13. | B | 14. | D | 15. | C |
| 16. | C | 17. | B | 18. | C | 19. | A | 20. | A |
| 21. | C | 22. | C | 23. | C | 24. | B | 25. | C |
| 26. | C | 27. | D | 28. | C | 29. | B | 30. | C |

### Contextual questions

1.1 If a net (resultant) force acts on an object, the object will accelerate in the direction of the net force. The acceleration is directly proportional to the net force and inversely proportional to the mass of the object.

1.2




$F_N$: normal force of surface on car/trailer: upward
w = $F_g$: gravitational attraction force of earth on car/trailer (weight): downward
f: frictional force of surface on car/trailer: opposite direction of motion
F: applied force on car: direction of motion
$F_T$ = T: force of rod on car: opposite direction of motion; and force of rod on trailer: direction of motion

1.3 i)

$F_{net} = ma$
$T - f_1 = ma$
$T - 3 = 3a$ (1)

AND

$40 - T - 5 = 5a$ (2)

(1) + (2)

$T - 3 = 3a$
$40 - T - 5 = 5a$
$32 = 8a$
$a = 4\ m{\cdot}s^{-2}$

$\therefore$ 4 $m{\cdot}s^{-2}$ right

ii) Substitute a = 4 $m{\cdot}s^{-2}$ in (1) (or in (2))

$T - 3 = 3a$
$T - 3 = 3(4)$
$T = 15$ N to the right

2.1 If the mass of an object increases and the net force acting on an object remains constant, the acceleration of the object will decrease.

2.2

| acceleration ($m \cdot s^{-2}$) | $\frac{1}{mass}$ ($kg^{-1}$) |
|---|---|
| 4,4 | **1** |
| 2,8 | **0,5** |
| 2,3 | **0,33** |
| 1,9 | **0,25** |

2.3


Did you:
- provide your graph with a heading?
- label the axes correctly?
- indicate the correct units?
- indicate the origin?
- calibrate the axes correctly?
- plot the points visibly?
- draw the line of best fit?

2.4 If the net force acting on an object is constant, the acceleration of the object is inversely proportional to its mass.

2.5 The greater mass implies a greater weight, which in turn results in a greater normal force. The previous compensation for friction is no longer effective.

2.6 Greater mass has smaller acceleration. Therefore it takes longer to stop which increases the stopping distance, and one underestimates the time needed to avoid an accident.

2.7 $v_f^2 = v_i^2 + 2a\Delta x$
$= 0^2 + 2(4,4)(10)$
$= 88$
$v = +9,38\ m \cdot s^{-1}$
$\therefore 9,38\ m \cdot s^{-1}$ in the direction of motion

3.1
- A is the backward force of the foot on the ground.
- B is the forward force of the ground on the foot which propels the foot forward.
- $F_{foot\ on\ ground} = -F_{ground\ on\ foot}$
- Your foot can grip the ground and the ground can apply an equal but opposite force on your foot, because of friction.