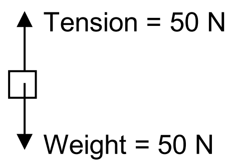
2025 Sec 3 Physics Dynamics Assignment 6.1 to 6.4

Answers

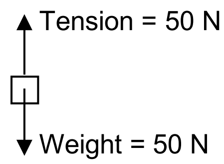
AS 6.1

1

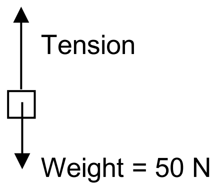
(i) Block P



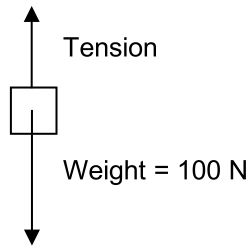
(ii) Block Q



(iii) Block N



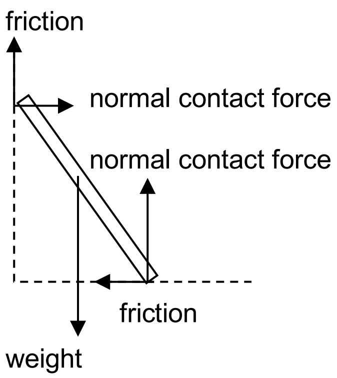
(iv) Block M



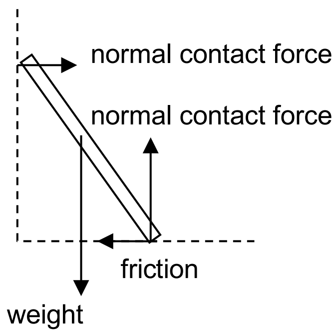
Note

- P & Q: If a body is at rest, F_{net} = 0 N, forces are <u>balanced</u>. There is <u>no net force</u>.
- M & N: If there is a F_{net}, forces are <u>unbalanced</u>, a body will accelerate (by Newton's 2^{nd} law of motion).

c. ladder K



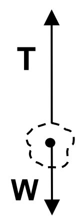
d. Ladder L



2.

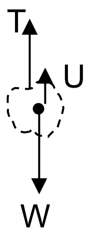
a.

T: Tension (by string)
W: Weight (by Earth)

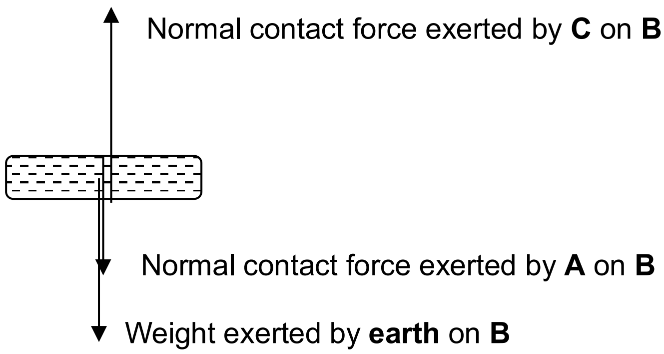


b.

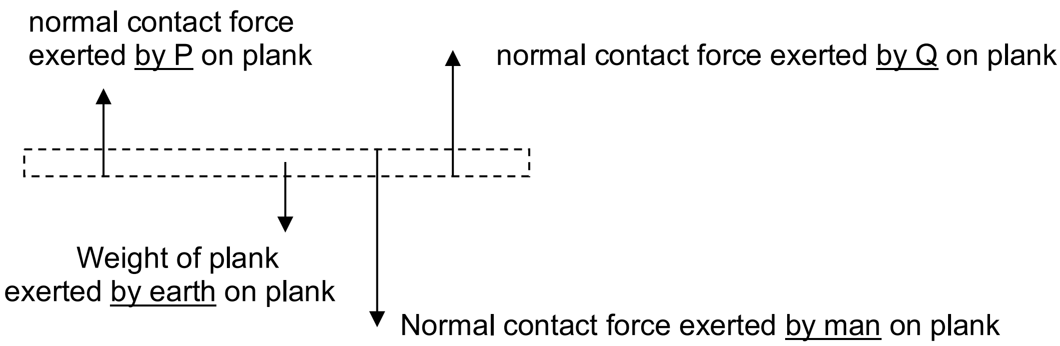
T: Tension (by string)
W: Weight (by Earth)
U: Upthrust (by water)



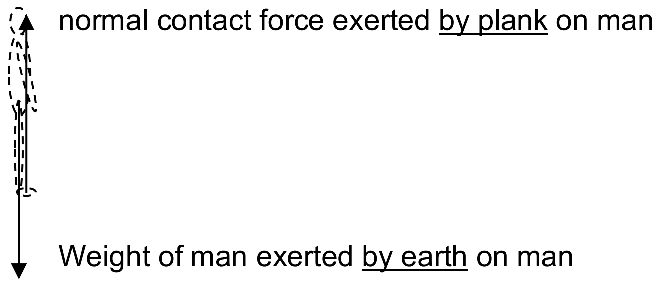
3



4 (a)

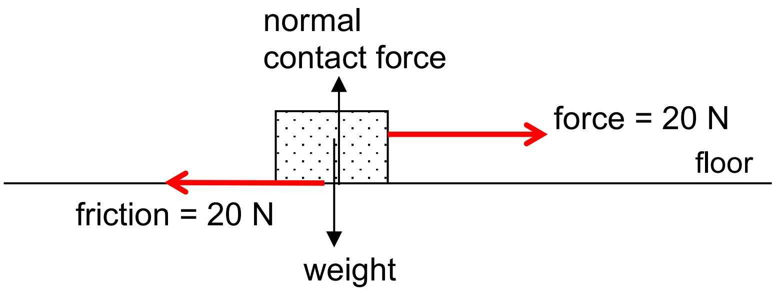


(b)



AS 6.2

1.



Note: Paraphrase the physics law, do not state the entire law!

2. It continues to move with the same velocity it had when its engine died. By Newton's First Law of Motion, there is no change in its motion since no force acts on it in outer space.

3. (a) 0 N
The lift is moving with constant velocity, the resultant force on it is zero, according to Newton's first law of motion

(b) 0 N
The lift is still moving with constant velocity, even though it is of a greater magnitude, the resultant force on it is zero, according to Newton's first law of motion

(c) 0 N
The lift is still moving with constant velocity, even though it is in the opposite direction, the resultant force on it is zero, according to Newton's first law of motion

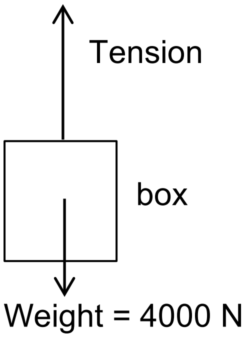
4. (a) The speed of the car increases, hence air resistance increases until a maximum value is reached.
(b) Fnet = forward thrust – resistive force = F - R
The increase in air resistance leads in the increase in the total resistive force. Hence the net force on the car decreases causing its acceleration to decrease. Eventually, the net force becomes zero and the acceleration of the car will also decrease to zero.

(c) The speed of the car will increase until it reaches a maximum value.
[This occurs when the constant forward thrust balances the total resistive force.]

AS 6.3

> **Note**:
> 1. State the equation or formula to be used.
> Start with Fnet = ma
> 2. Show working/explain steps CLEARLY!

1. (a)



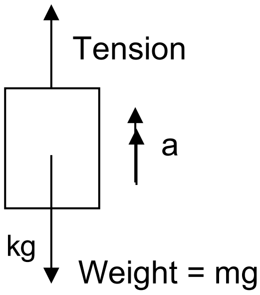
(b) T – W = ma; Ma = T – mg
a = (4100 – 4000) / 400 = 0.25 m s^{-2}

(c) v = u + at, u = 0
➔ v = 2.5 m s^{-1}
s = ut + ½ at^2
➔ s = 12.5 m

(d) a = - 0.25 m s^{-2} or 0.25 m s^{-2} (downwards)

(e) 4000 N

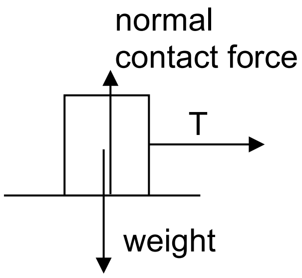
2. (a)

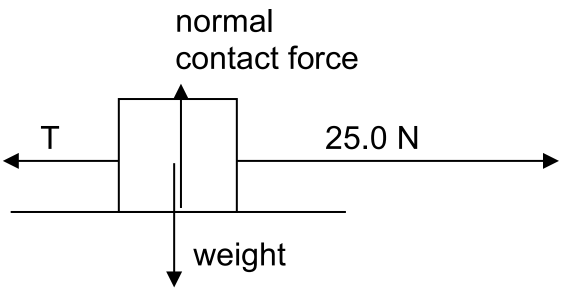


(b) F_{net} = ma
T – W = ma
T – mg = ma
m (g + a) = T
m = 5750 / (10 + 2.0) = 479 = 480 kg

(c) T – mg = ma
T = m(g + a)
T = 479 (10 - 2) = 3832 = 3800 N

3. (a)





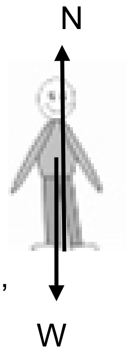
(b) On 3.0 kg block: T = 3a
On 7.0 kg block: 25 - T = 7a
25 - 3a = 7a
Therefore, a = 2.5 m s^{-2}
T = 7.5 N

(c) Blocks move at constant velocity, therefore, no net force on each block. Therefore, friction acting on each block will cause all forces acting on the respective block to be balanced.

On 3.0 kg block, T = 7.5 N, therefore, friction = **7.5 N**
On 7.0 kg block, originally, net force was 25.0 - 7.5 = 17.5 N to the right, Therefore, friction = **17.5 N** in order to balance the applied force and the tension.

4. (a) N: Normal contact force exerted by the weighing scale on the man
W: Weight of the man

Weighing scale reads the magnitude of the *normal contact force!*



(b) As the lift accelerates upwards, the man accelerates with the lift. Therefore, the man also accelerates upwards at 2.0 m s^{-2}.

Applying Newton's 2^{nd} Law,
Resultant force = m a   taking upwards as positive
N - W = 60 (2.0)
N - 600 = 60 (2.0)
Therefore, N = 600 + 120 = **720 N**.
The weighing scale reads 720 N or 72 kg.

(c) As the lift decelerates upwards, the man also decelerates upwards at 2.0 m s^{-2}
Resultant force = m a   taking upwards as positive
N - W = 60 (- 2.0)
N - 600 = 60 (- 2.0)
Therefore, N = 600 - 120 = **480 N**.
The weighing scale reads 480 N or 48 kg.

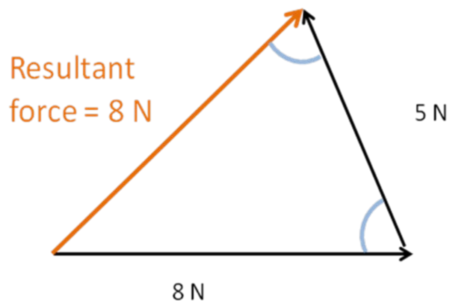
AS 6.4

Note: In vector triangle a. label the forces with symbols or known values
b. place the arrowhead in the middle of each side!

1. (a) Not possible. Maximum Fnet = 5 N + 8 N = 13 N.

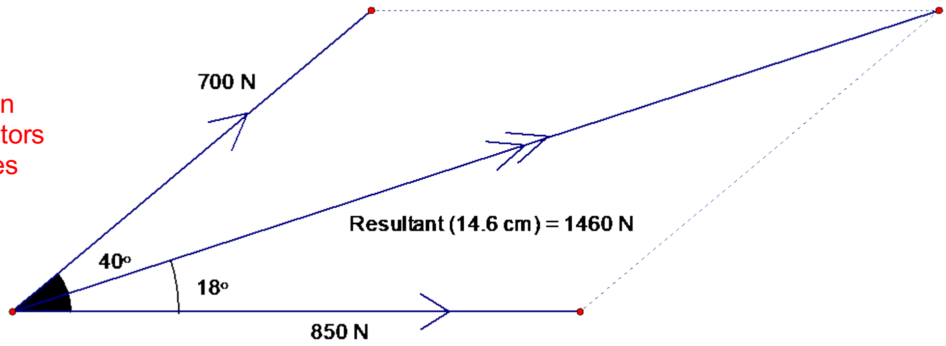
(b) Possible! 8 N is between minimum (3 N) and maximum (13 N)

Vector triangle is an isosceles triangle.



2.
Note: Draw a <u>sketch</u> first before drawing a <u>scale</u> diagram.

Diagram:
- correct vector addition
- label arrows of all vectors
- label all suitable angles



Scale: 1.0 cm represents 100 N (choose a scale to
Magnitude of the resultant force: <u>1460 N</u>
Angle between the the resultant and that of the 850 N force: <u>18° anticlockwise</u>
(Measure angle accurately with protractor to the nearest degree.)

Note: Answers can be checked <u>by calculation</u> using cosine rule.

3. Vector triangle is an <u>isosceles triangle</u>.
Divide it into two equal <u>right-angled triangles</u>.

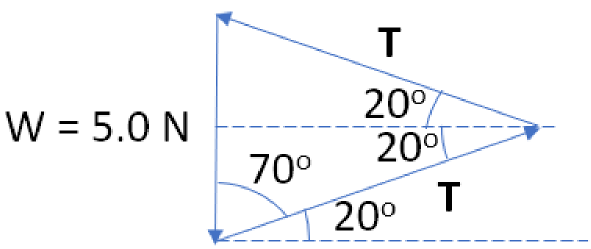
W = 5.0 N

Using trigonometry,

$$\cos 70^\circ = \frac{(\frac{1}{2} W)}{T}$$

$T = 2.5 / \cos 70^\circ$

$= 7.3$ N (2s.f.)



For scale drawing (1.0 cm: 1.0N)

Accept 7.2 to 7.4 N

4.
Note: Draw a sketch first before drawing a scale diagram.

Scale: 1.0 cm represents 10 N

$T_1 = 8.7 \times 10\ N = 87\ N$

$T_2 = 6.6 \times 10\ N = 66\ N$

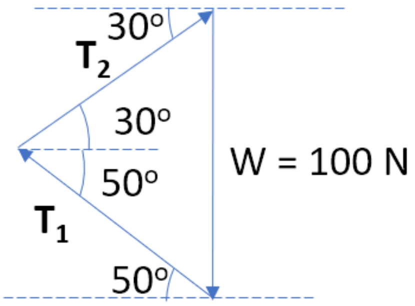


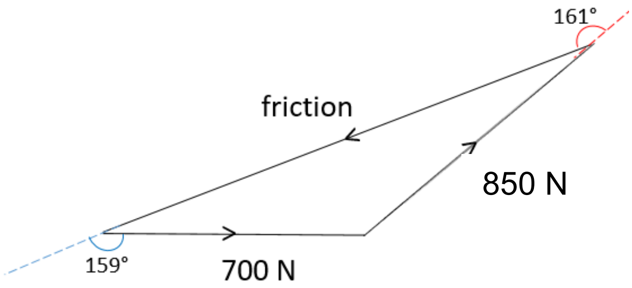
*Diagram above **not** drawn to scale*

Note: Answers can be checked by calculation
- Using vector resolution: in x- and in y-directions
  OR
- Using sine rule

5.

Note: Choose a suitable scale to maximize the use of the given space to draw the vector triangle!

Scale 1.0 cm : 100 N
(Since the rock is in equilibrium, the 3 forces must form a closed triangle)



Magnitude of friction = $14.6 \times 100\ N = 1460\ N$
Direction of friction:
159° clockwise from the 700 N force, or
161° anticlockwise from the 850 N force

[Direction depends on the relative position of the 2 original forces.]