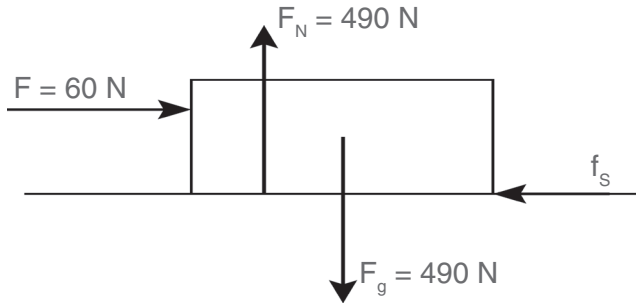
Exercise 3: Page 40

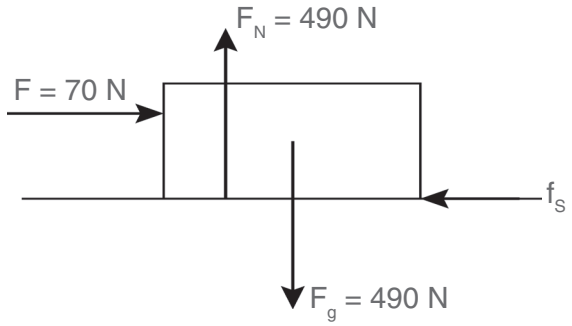
1.



b) Crate does not move
∴ static friction.

c) $f_S = F = 60$ N
Vertical equilibrium
$F_g = m \times g$
$= 50 \times 9{,}8$
$= 490$ N

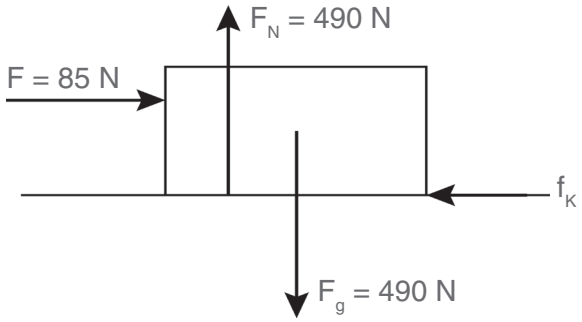
2.



b) Crate is at the point of moving.
∴ $f_{S\,(max)}$

c) $f_S = F$
$= 70$ N

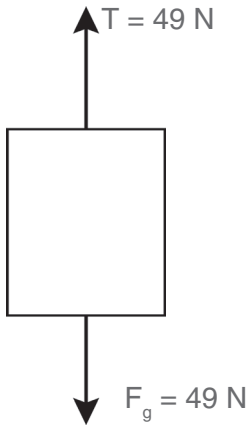
3.



b) Crate is moving, therefore it is kinetic friction.

c) $F - f_K = m \times a$

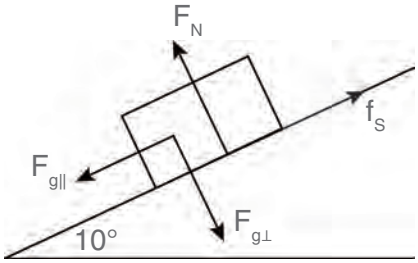
4.



b) No friction; objects must be in contact in order to have friction.

c) The picture does not move.
∴ $T = F_g$
$= 5 \times 9{,}8$
$= 49$ N

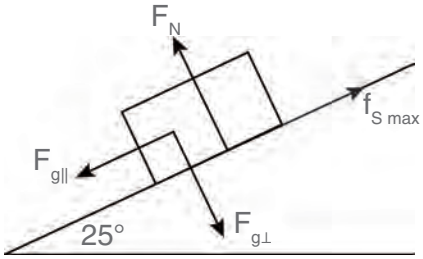
5.



b) The crate does not move ∴ static friction.

c) $f_S = F_{g\parallel}$ $f_S = mg\sin\theta$
$= F_g \sin\theta$ $= 60 \times 9{,}8 \sin 10°$
$= mg\sin\theta$

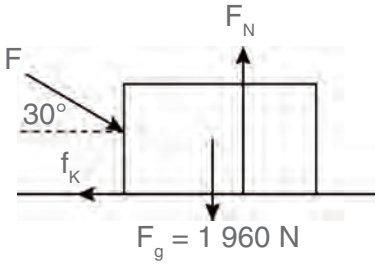
6.



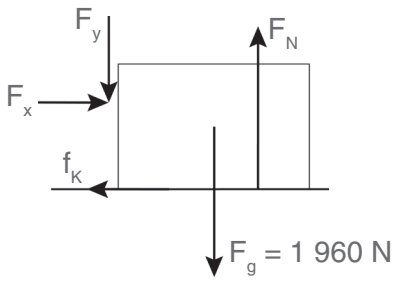
b) Crate is at the point of moving
∴ $f_{S\,max}$.

c) F_S is in the opposite direction to $F_{g\parallel}$.
$f_S = F_{g\parallel}$ OR $f_S = \mu F_N$
$= F_g \sin\theta$ $= \mu F \cos 25°$
$= m \times 9{,}8 \times \sin 25°$

7.



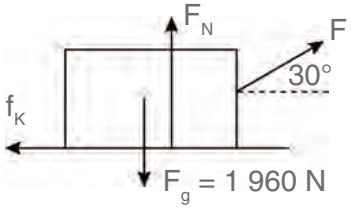
OR

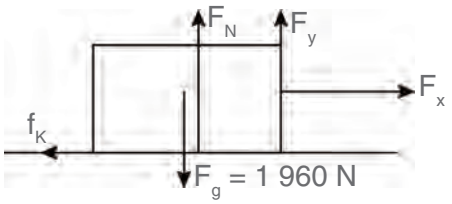


b) Roller moves ∴ kinetic friction.

c) First calculate the components of the applied force (push):
$F_x = F\cos\theta$
$F_y = F\sin\theta$
$F_x - f_K = m \times a$
OR
$f_K = \mu F_N$
$= \mu(F_g - F_y)$

8.

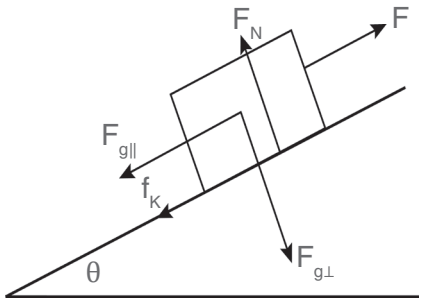




b) Roller moves ∴ kinetic friction.

c) Force is divided into its components:
$F_x = F\cos\theta$
$F_y = F\sin\theta$
$F_x - f_K = m \times a$
OR
$f_K = \mu F_N$
$= \mu(F_g - F_y)$

9.



b) Crate moves ∴ kinetic friction.

c) Weight is divided into its components:

$F_{g\parallel} = F_g \sin\theta$

$F_{g\perp} = F_g \cos\theta$

$F - (F_{g\parallel} + f_K) = ma = 0$

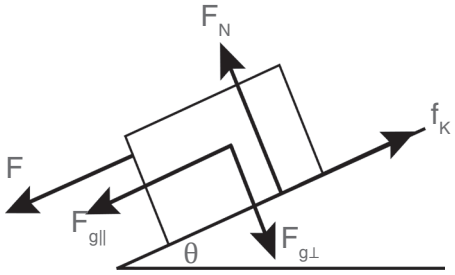
OR

$f_K = \mu F_N$

$= \mu F_g \cos\theta$

$= \mu \cdot mg \cdot \cos\theta$

10.



b) Roller moves ∴ kinetic friction.

c) Weight is divided into its components:

$F_{g\parallel} = F_g \sin\theta$

$F_{g\perp} = F_g \cos\theta$

$(F + F_{g\parallel}) - f_K = m \times a$

$f_K = \mu F_N$

$= \mu F_g \cos\theta$

$= \mu \cdot mg \cdot \cos\theta$

Experiment 4: Page 46

Aim: Determine the resultant of two non-linear vectors.

Method:

4. Redraw an accurate copy of these forces in the space below.