

EPSE Project 1: Sample Diagnostic Questions - Set 5

Identifying forces

These questions all probe pupils' ability to identify the separate forces acting in simple situations, where things are being pushed or pulled. Q1 begins with a situation where the cause of the forces is obvious. In Qs2-4, 'invisible' forces like friction, gravity and reaction of a surface are involved, making these slightly harder.

Qs5-6 are about labelling marked forces; here the emphasis is on being clear about what is exerting the force and what it is acting on. In analysing any example of motion, it is essential to be able to recognise clearly which object each force is acting on, so that you can add up all the forces acting on a given object to predict (or explain) how it moves.

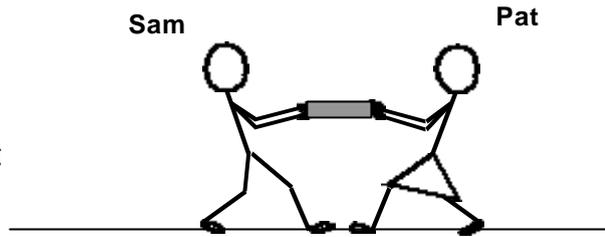
Qs7-10 seem similar to the earlier ones, but have an important difference which makes them more challenging. These all require the pupil to recognise that all forces come in pairs, so that if a person pulls an object, he or she also experiences a force exerted by the object, in the opposite direction.

These questions are taken from a larger bank of diagnostic questions and tasks developed by the *Evidence-based Practice in Science Education (EPSE) Research Network*. The EPSE network was funded between 1999 and 2003 by the UK Economic and Social Research Council (ESRC) as part of the *Teaching and Learning Research Programme (TLRP)*.

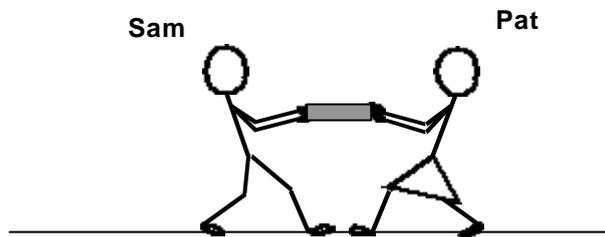
1

Sam and Pat both want to have the same book.

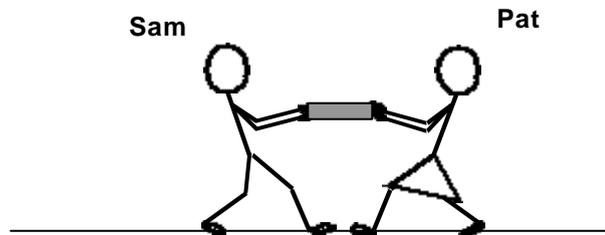
Both are pulling on the book but it is **not moving**.



(a) On this diagram, mark with an arrow **the force exerted by Sam on the book**.



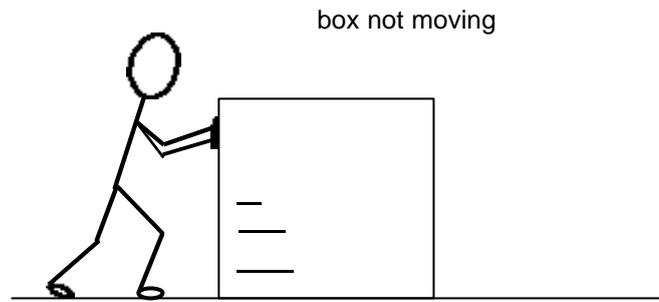
(b) On this diagram, mark with an arrow **the force exerted by Pat on the book**.



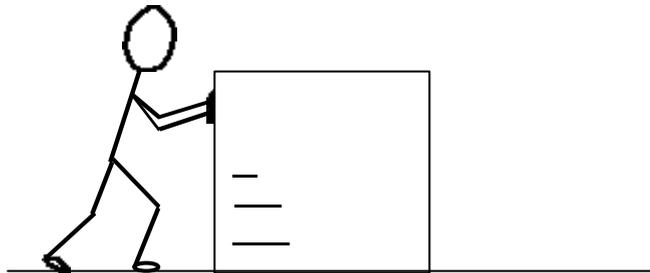
2

A workman is pushing a heavy box to move it across the floor.

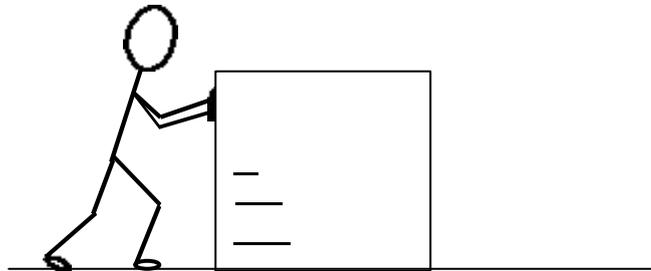
But the box is **not moving**.



(a) On this diagram, mark with an arrow **the force exerted by the workman on the box**.

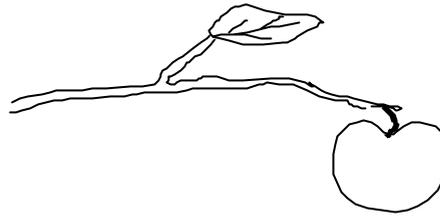


(b) On this diagram, mark with an arrow **the force exerted by the floor on the box (the friction force on the box)**.

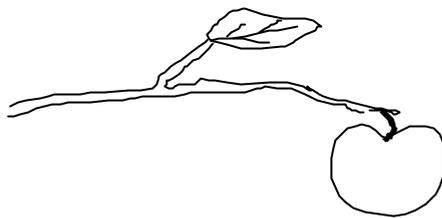


3

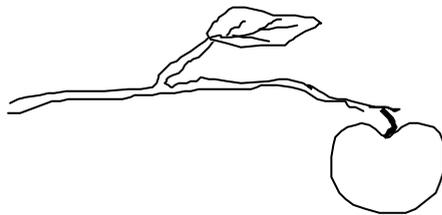
An apple is hanging on a branch.



(a) On this diagram, mark with an arrow **the force exerted by the Earth on the apple (the force of gravity)**.

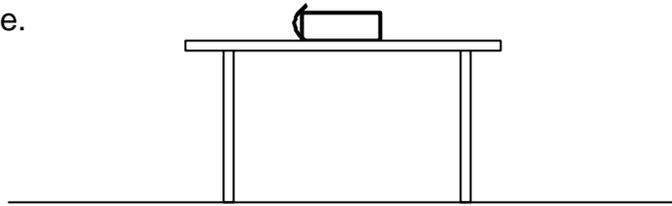


(b) On this diagram, mark with an arrow **the force exerted by the branch on the apple**.

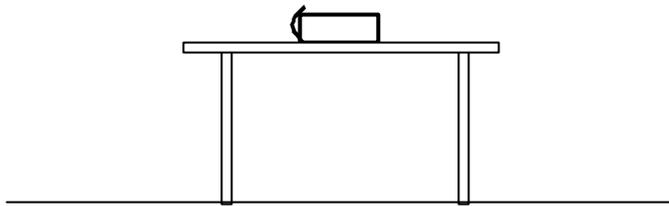


4

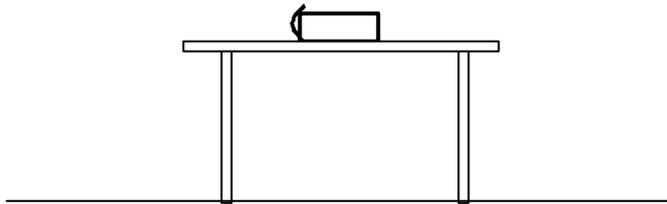
A heavy book is sitting on a table.



(a) On this diagram, mark with an arrow **the force exerted by the Earth on the book (the force of gravity).**



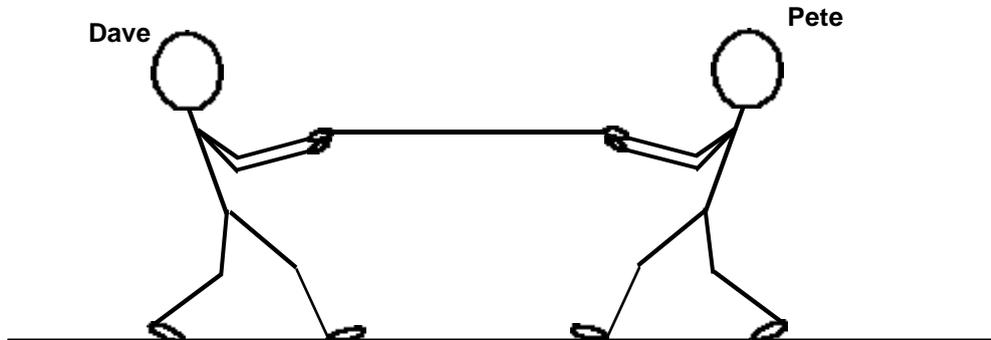
(b) On this diagram, mark with an arrow **the force exerted by the table on the book.**



5

Dave and Pete are having a tug-of-war.

Both boys are pulling on the rope but it is **not moving**.



Each of the diagrams below shows one of the forces involved in this situation.

For each force, write a label that says clearly what the force is. Write it in the form:
force exerted by [something] on [something]

(a)

Diagram (a) shows the same stick figures Dave and Pete pulling on the rope. A horizontal arrow points from the rope towards Pete's hand, representing a force exerted on Pete.

Label for this force: _____

(b)

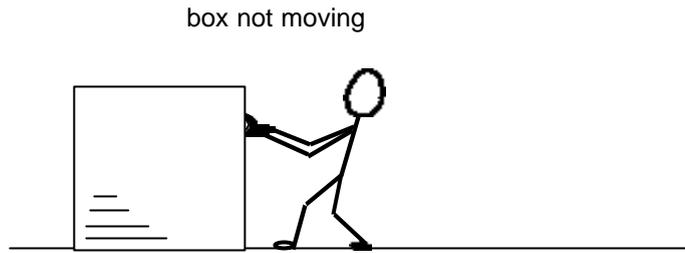
Diagram (b) shows the same stick figures Dave and Pete pulling on the rope. A horizontal arrow points from the rope towards Dave's hand, representing a force exerted on Dave.

Label for this force: _____

6

A workman is trying to pull a heavy box across the floor.

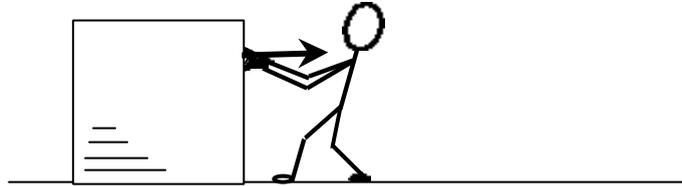
The box but it is **not moving**.



Each of the diagrams below shows one of the forces involved in this situation.

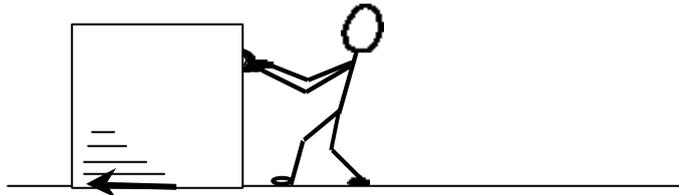
For each force, write a label that says clearly what the force is. Write it in the form:
force exerted by [something] on [something]

(a)



Label for this force: _____

(b)

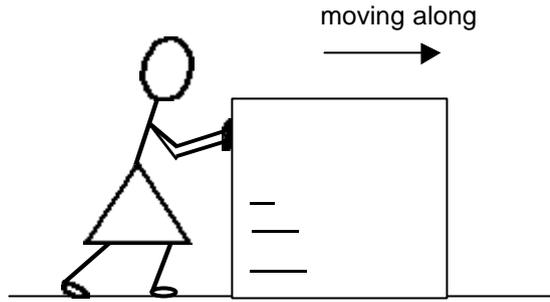


Label for this force: _____

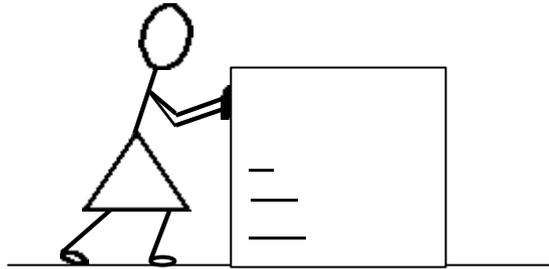
7

Karen is pushing a large box across the floor.

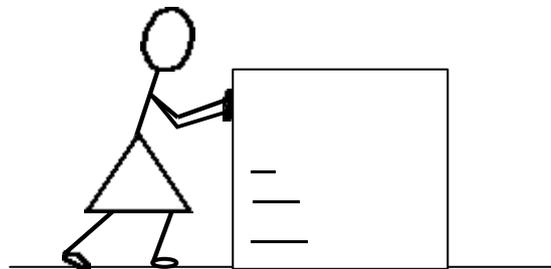
It is moving steadily.



(a) On this diagram, mark with an arrow **the force exerted by Karen on the box.**

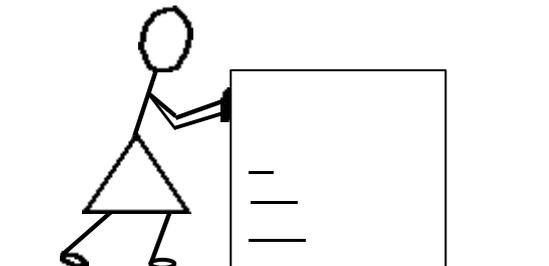


(b) On this diagram, mark with an arrow **the force exerted by the floor on the box (the friction force on the box).**



(b) Is there a **force exerted by the box on Karen?** _____

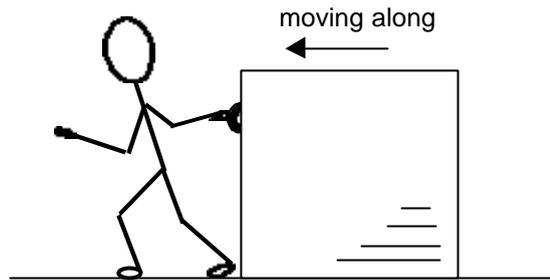
If you think there is, mark it with an arrow on the diagram below.



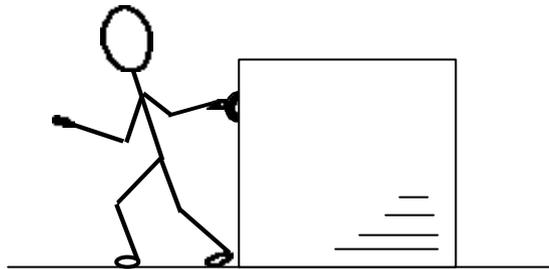
8

Ken is pulling a large box across the floor.

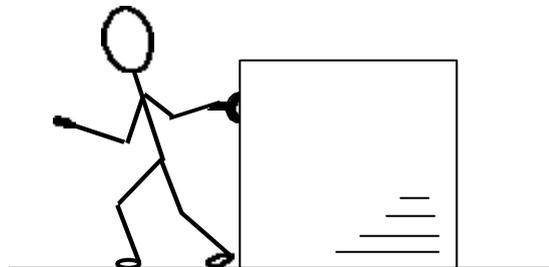
It is moving steadily.



(a) On this diagram, mark with an arrow **the force exerted by Ken on the box.**

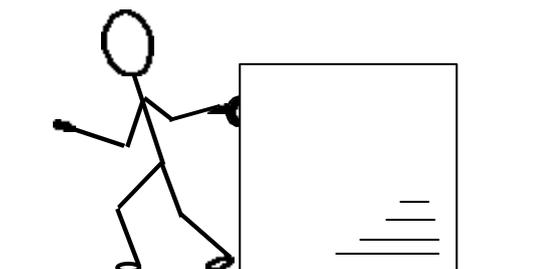


(b) On this diagram, mark with an arrow **the force exerted by the floor on the box (the friction force on the box).**



(c) Is there a **force exerted by the box on Ken?** _____

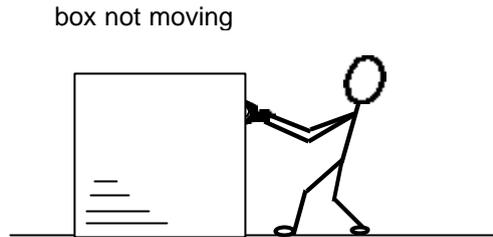
If you think there is, mark it with an arrow on the diagram below.



9

This workman is pulling a heavy box to try and move it along.

But the box is **not moving**.



In the boxes below, you are asked to mark the forces acting on each object involved in this situation.

Represent forces:

- by drawing arrows to show the direction of each force, 
- with the **length** of the arrow representing the **size** of the force.

Label each force to indicate what it is.

- (a) On this diagram, mark all the horizontal forces acting **on the box**. (Ignore any vertical forces.)



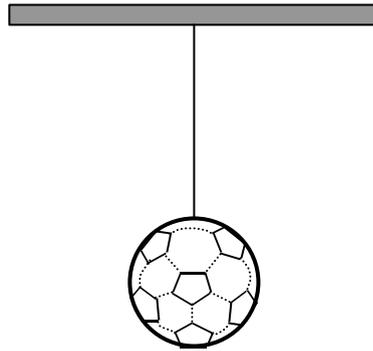
- (b) On this diagram, mark all the horizontal forces acting **on the workman**. (Ignore any vertical forces.)



10

This football is hanging from a string.

The other end of the string is tied to the ceiling.



In the boxes below, you are asked to mark the forces acting on each object involved in this situation.

Represent forces:

- by drawing arrows to show the direction of each force,
- with the **length** of the arrow representing the **size** of the force.



Label each force to indicate what it is.

(a) On this diagram, mark all the forces acting **on the ball**.



(b) On this diagram, mark all the forces acting **on the string**.

