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marks

Question 21 (7 marks).

A Truck Arrestor Bed is a sand and gravel filled lane that a truck can use when its brakes fail.

Q4158



Source: <https://bbs.boingboing.net/t/footage-of-brakeless-trucks-using-emergency-stop-pits/194680/2>

A 10 000 kg truck with failed brakes enters the Arrestor Bed at 64.8 km hr^{-1} . The truck slows at a constant rate, coming to rest in 6 seconds.

- (a) Complete the vector diagram showing and labelling all the horizontal forces acting on the truck.

Q4158a

2



Student Number								
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marks

(b) Calculate the acceleration of the truck as it comes to a stop.

Q4158b

2

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(c) Calculate the net force on the truck.

Q4158c

3

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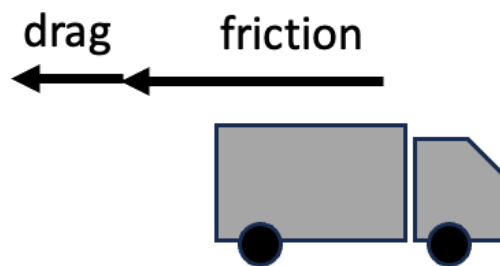
Section II

Q4158 Question 21 QR



a)
 There is a backwards force on it caused by the resistance from the sand filled bed. The truck pushes the sand forwards and so it pushes back on the truck -Newton’s 3rd law.

Suggested response



Marking Guide	Mark range
Shown only backwards forces on the truck, with at least one relevant label	2
Demonstrates some understanding	1

Marking Guide: This is an entry-level question, so any words which recognise that there is a force (force-related words like friction, drag, etc) causing this slowing down is sufficient.

b)
 Suggested Response

$$\Delta t = 6 \text{ s}, u = \frac{64.8}{3.6} = 18 \text{ m s}^{-1}, v = 0 \text{ m s}^{-1}, m = 10,000 \text{ kg}$$

$$v = u + a\Delta t$$

$$a = \frac{v - u}{\Delta t} = \frac{0 - 18}{6} = -3 \text{ m s}^{-2}, \text{ or } 3 \text{ m s}^{-2} \text{ backwards}$$

Marking Guide	Mark range
Correct substitution and units (direction not marked for)	2
Demonstrates some understanding	1

c)
 Suggested Response

$$F = ma = 10,000 \times -3 = -30,000 \text{ N or } 30,000 \text{ N backwards}$$

Marking Guide	Mark range
Correct substitution and units {following errors}, identifies direction (either -ve sign or in words)	3
Correct substitution and units {following errors} missing or incorrect direction	2
Demonstrates some understanding	1