Cambridge Assessment International Education

Cambridge IGCSE™

8: Mechanics 2 – Topic questions

Paper 4

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
2	2016	June	41
3	2016	June	41
2	2016	March	42

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

2 Fig. 2.1 shows a dummy of mass 70 kg used in a crash test to investigate the safety of a new car.

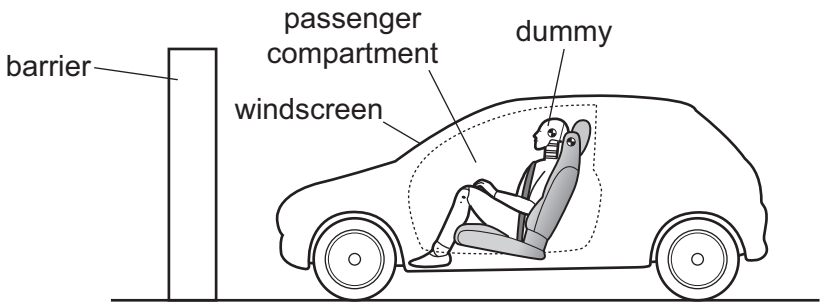

Fig. 2.1

The car approaches a solid barrier at 20 m / s. It crashes into the barrier and stops suddenly.

(a) **(i)** Calculate the momentum of the dummy immediately before the crash.

momentum = ... [2]

(ii) Determine the impulse that must be applied to the dummy to bring it to rest.

impulse = ... [1]

(b) In the crash test, the passenger compartment comes to rest in 0.20 s.

Calculate the deceleration of the passenger compartment.

deceleration = ... [2]

(c) The seat belt and air bag bring the dummy to rest so that it does not hit the windscreen. The dummy has an average deceleration of 80 m / s^2.

Calculate the average resultant force applied to the dummy, of mass 70 kg.

force = ... [2]

(d) The deceleration of the dummy is less than the deceleration of the passenger compartment.

Explain why this is of benefit for the safety of a passenger.

.....

.....

.....

.....

.....

..... [2]

[Total: 9]

3 Fig. 3.1 shows an oil tank that has a rectangular base of dimensions 2.4 m by 1.5 m.

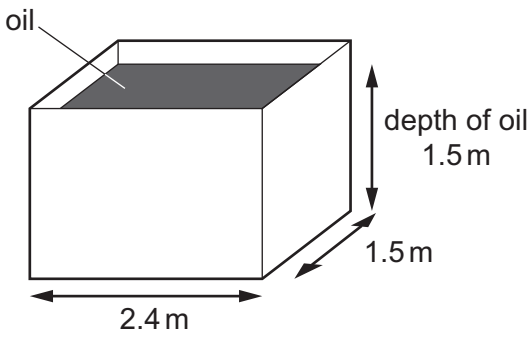

Fig. 3.1

The tank is filled with oil of density 850 kg / m^3 to a depth of 1.5 m.

(a) Calculate

(i) the pressure exerted by the oil on the base of the tank,

pressure = ... [2]

(ii) the force exerted by the oil on the base of the tank.

force = ... [2]

(b) The force calculated in **(a)(ii)** is the weight of the oil.

Calculate the mass of oil in the tank.

mass = ... [1]

(c) When he is checking the level of oil in the tank, a man drops a brass key into the oil and it sinks to the bottom of the oil.

(i) State what this shows about the density of brass.

..... [1]

(ii) Explain how attaching the key to a piece of wood could prevent the key from sinking.

.....

.....

..... [1]

[Total: 7]

2 Fig. 2.1 shows a hammer being used to drive a nail into a piece of wood.

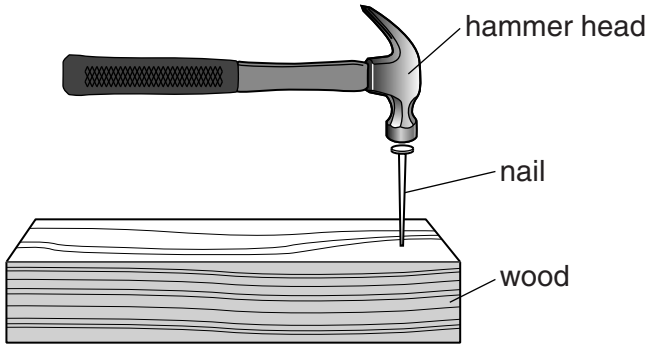

Fig. 2.1

The mass of the hammer head is 0.15 kg.
The speed of the hammer head when it hits the nail is 8.0 m/s.
The time for which the hammer head is in contact with the nail is 0.0015 s.

The hammer head stops after hitting the nail.

(a) Calculate the change in momentum of the hammer head.

change in momentum = ...[2]

(b) State the impulse given to the nail.

impulse = ...[1]

(c) Calculate the average force between the hammer and the nail.

average force = ...[2]

[Total: 5]

Question	Answer	Mark
2 (a)	mv – mu **OR** m(v – u) **OR** mv **OR** 0.15 × 8.0 1.2 N s or kg m / s	C1 A1
2 (b) (i)	1.2 N s or kg m / s	B1
2 (c)	F = (mv – mu) / t **OR** F = mv / t **OR** impulse / t **OR** 1.2 / 0.0015 800 N **OR** (F =) ma **OR** m[(v – u) / t] **OR** 0.15 × 8 / 0.0015 800 N	C1 A1 (C1) (C1)
		Total: 5
2 (a) (i)	(momentum =) mv **OR** 70 × 20 = 1400 kg m / s **OR** N s	C1 A1
2 (a) (ii)	same numerical answer as **(a)(i)** with either unit **OR** 1400 kg m / s	B1
2 (b)	(a =) change of velocity / time **OR** (v – u) /t **OR** 20 / 0.2 100 m / s^2	C1 A1
2 (c)	(F =) ma **OR** 70 x 80 5600 N	C1 A1
2 (d)	Force / impact on passenger or dummy less (than without seat belt / airbag) Passenger less likely to be injured / hurt / damaged	M1 A1
		Total: 9
3 (a) (i)	(P =) hdg **OR** 1.5 × 850 × 10 **OR** mg / area of base **OR** 850 × 2.4 × 1.5 × 1.5 × 10 / (2.4 × 1.5) 13 000 Pa or N/m^2	C1 (C1) A1
3 (a) (ii)	P = F/A **OR** (F =) PA **OR** 12 750 × 1.5 × 2.4 **OR** 12 750 × 3.6 46 000 N **OR** (Force =) weight of oil = mg = 2.4 × 1.5 × 1.5 × 850 × 10 46 000 N	C1 A1 (C1) (A1)
3 (b)	(46000 / 10 =) 4600 kg **OR** m = Vd = (2.4 × 1.5 × 1.5) × 850 = 4600 kg	B1
3 (c) (i)	(density of brass) greater than that of oil / 850 kg / m^3 **OR** brass denser <u>than oil</u>	B1
3 (c) (ii)	(it won't sink as average) density of wood + key less than density of oil	B1
		Total: 7

Notes about the mark scheme are available separately.