

## Newton's Laws Questions

- 1 (a) (i) State Newton's first law of motion.

.....  
.....  
..... [1]

- (ii) Define the *newton*.

.....  
..... [1]

- (b) A jet plane on the deck of an aircraft carrier is accelerated before take-off using a catapult. The mass of the plane is  $3.2 \times 10^4$  kg and it is accelerated from rest to a velocity of  $55 \text{ m s}^{-1}$  in a time of 2.2s. Calculate

- (i) the mean acceleration of the plane

mean acceleration = .....  $\text{m s}^{-2}$  [2]

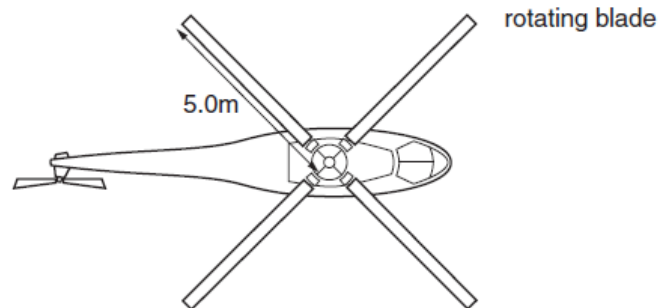
- (ii) the distance over which the acceleration takes place

distance = ..... m [2]

- (iii) the mean force producing the acceleration.

mean force = ..... N [1]

(b) Fig. 1.2 shows a helicopter viewed from above.



**Fig. 1.2**

The blades of the helicopter rotate in a circle of radius 5.0m. When the helicopter is hovering, the blades propel air vertically downwards with a constant speed of  $12\text{ m s}^{-1}$ . Assume that the descending air occupies a uniform cylinder of radius 5.0m.

The density of air is  $1.3\text{ kg m}^{-3}$ .

- (i) Show that the mass of air propelled downwards in a time of 5.0 seconds is about 6000kg.

[2]

(ii) Calculate

- 1 the momentum of this mass of descending air

momentum = .....  $\text{kgms}^{-1}$  [1]

- 2 the force provided by the rotating helicopter blades to propel this air downwards

force = ..... N [2]

- 3 the mass of the hovering helicopter.

mass = ..... kg [1]

**[Total: 13]**

- 5 A car of mass 970kg is travelling at  $27 \text{ m s}^{-1}$  when the brakes are applied. The car is brought to rest in a distance of 40m.
- (a) (i) Calculate the kinetic energy of the car when it is travelling at  $27 \text{ m s}^{-1}$ .

kinetic energy = ..... J [1]

- (ii) Hence calculate the average braking force on the car stating any assumption that you make.

average braking force = ..... N

assumption .....  
..... [3]

- 1 (a) State Newton's second and third laws of motion.



*In your answer, you should use appropriate technical terms spelled correctly.*

- (i) second law

.....  
.....  
..... [1]

- (ii) third law

.....  
.....  
..... [1]

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- (iv) The ground is level. The ball leaves the ground at a velocity of  $50 \text{ m s}^{-1}$  at an angle of  $42^\circ$  to the horizontal. Determine the horizontal distance travelled by the ball before it hits the ground.

State **one** assumption that you make in your calculations.

distance = ..... m

assumption .....

..... [5]