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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Forces (Dynamics)

Paper 2 — Theory Worksheet (topical compilation)

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The City School

PAF CHAPTER

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DYNAMICS P2

Question # 1: May June 2012/P22/Q2

(a) State what is meant by *friction*.

.....

.....[2]

(b) Fig. 2.1 shows two horizontal forces that act on a car. Force B is caused by air resistance and friction.

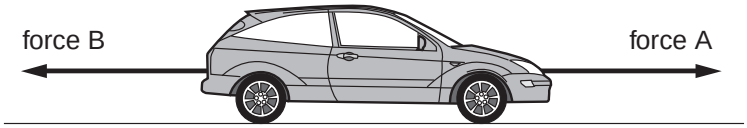

Fig. 2.1

The car is travelling along a straight level road.

(i) The forward force A and the backward force B are equal.
Describe the motion of the car.

.....

.....[1]

(ii) The mass of the car is 800 kg.
Force A increases to 5000 N. This causes the car to accelerate initially at 1.5 m/s^2.
Calculate the size of force B.

force B = ...[3]

(iii) Force A remains constant at 5000 N. Explain why the acceleration decreases as the car travels along the level road.

.....

.....[2]

Question # 2: May June 2014/P22/Q1

Fig. 1.1 shows a lorry accelerating in a straight line along a horizontal road.

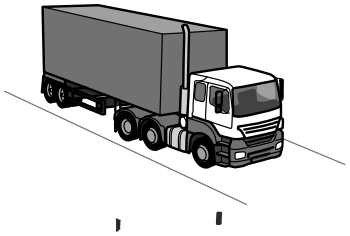

Fig. 1.1

(a) The driving force on the lorry in the forward direction is *D* and the total backward force on the lorry is *B*.

(i) State and explain whether *D* or *B* is the larger force.

.....

..... [1]

(ii) Suggest one possible cause of the backward force *B*.

..... [1]

(b) The weight of the lorry is 300 000 N.

The gravitational field strength *g* is 10 N / kg.

(i) Calculate the mass of the lorry.

mass = ... [1]

(ii) The resultant force on the lorry is 15 000 N. Calculate the acceleration of the lorry.

acceleration = ... [2]

(c) Later, the lorry turns a corner at constant speed.

Explain why the lorry accelerates even though the speed is constant.

.....

..... [1]

Question # 3: May June 2016/P22/Q1

Fig. 1.1 shows the speed-time graph for a car travelling along a horizontal road.

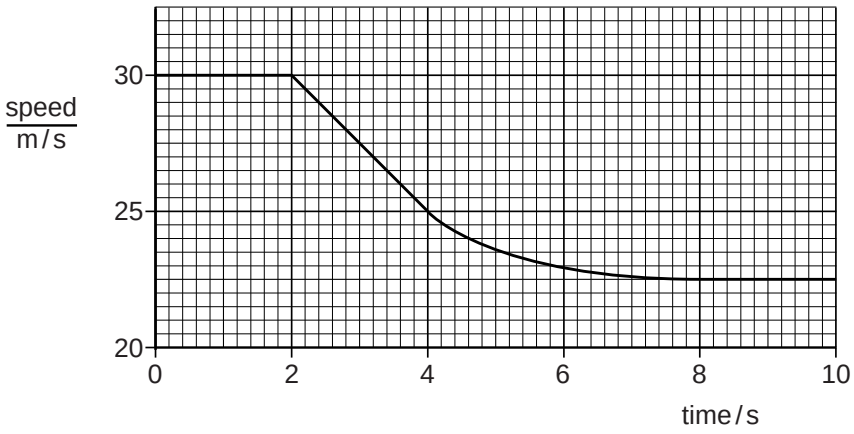

Fig. 1.1

(a) On Fig. 1.1, mark and label a point where the car has a non-uniform deceleration. [1]

(b) Calculate the deceleration of the car at $t = 3.0\,s$.

deceleration = ...[2]

(c) Explain, in terms of the horizontal forces that act on the car, why its speed is constant at $t = 1.0\,s$.

.....

.....

.....

.....[2]

Question # 4: May June 2017/P21/Q1

Fig. 1.1 shows the directions of four forces acting on a racing car as it travels in a horizontal straight line.

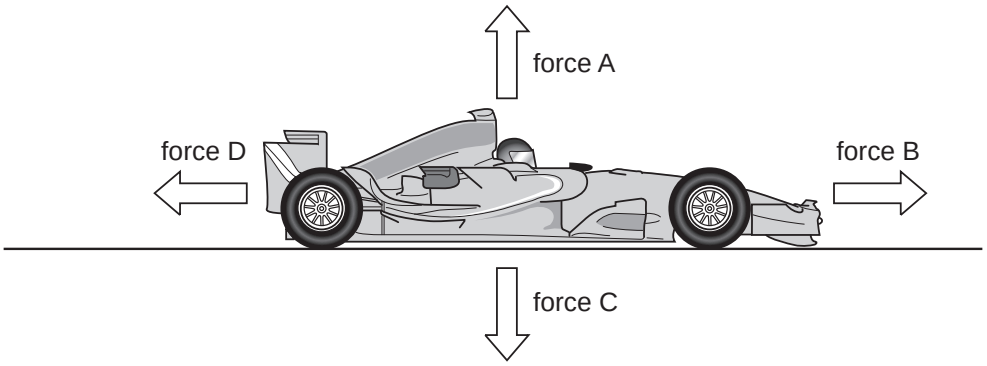

Fig. 1.1

(a) Draw a line from each box on the left to the correct description of each force.

force A	driving force
force B	contact or normal reaction force
force C	air resistance and friction
force D	force of gravity

[1]

(b) The table shows the sizes of the forces acting on the car at one time.

force A / N	force B / N	force C / N	force D / N
8000	1000	8000	600

The gravitational field strength g is 10 N / kg.

Calculate

(i) the mass of the car,

mass = ...[1]

(ii) the resultant force on the car,

resultant force = ...[1]

(iii) the acceleration of the car.

acceleration = ...[2]

(c) At another time, the car is travelling at speed u. It then accelerates for 5.0 s with an acceleration of 1.6 m / s^2, and reaches a speed of 20 m / s.

Calculate the value of u.

u = ...[2]

Question # 5: May June 2018/P21/Q2

Fig. 2.1 shows a man pushing a heavy box with a force *P*. A frictional force *F* acts in a horizontal direction.

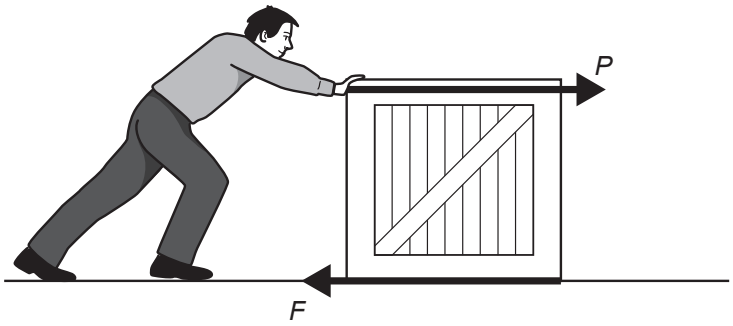

Fig. 2.1

(a) The forces on the box are *balanced* and the box is stationary.

(i) State what is meant by *balanced forces*.

.....

.....[1]

(ii) The frictional force in Fig. 2.1 does not produce any heating effect.

State what must happen for the frictional force to produce heating.

.....

.....[1]

(iii) Apart from being stationary, describe one other possible state of motion of the box when the forces are balanced.

.....

.....[1]

(b) When *P* = 100 N and *F* = 85 N, the box accelerates. The mass of the box is 25 kg.

Calculate the acceleration of the box.

acceleration = ...[3]

Question # 6: Oct Nov 2008/P2/Q4

A passenger aeroplane accelerates from rest along a runway. It accelerates at a uniform rate for 35 s. At this point it reaches a speed of 84 m / s and then takes off.

(a) (i) Calculate the acceleration of the aeroplane along the runway.

acceleration = ... [2]

(ii) Sketch a speed-time graph for the aeroplane as it travels along the runway.

[3]

(b) Two **horizontal** forces act on the aeroplane as it accelerates along the runway.

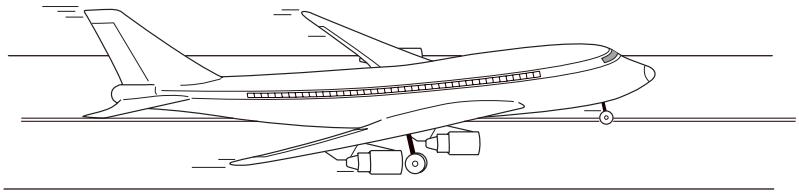

Fig. 4.1

(i) On Fig. 4.1, draw arrows to show the directions and the relative magnitudes of these forces. [1]

(ii) State what causes the smaller of these two forces.

..... [1]

Question # 7: Oct Nov 2010/P2/Q1

Fig. 1.1 shows a cricket ball as it comes into contact with a cricket bat.

Fig. 1.1

The cricket ball has a mass of 0.16 kg and it hits the bat with a speed of 25 m/s. After being in contact with the bat for 0.0013 s, the ball rebounds with a speed of 22 m/s in the direction exactly opposite to its original direction.

(a) State the difference between *speed* and *velocity*.

.....

..... [1]

(b) Calculate

(i) the change in velocity of the cricket ball,

velocity change = ... [1]

(ii) the average acceleration of the ball whilst it is in contact with the bat,

acceleration = ... [2]

(iii) the average force exerted on the ball by the bat.

force = ... [2]

Question # 8: Oct Nov 2014/P21/Q1

Fig. 1.1 shows a motorcycle during a race.

Fig. 1.1

The motorcycle accelerates along a straight section of the track from a speed of 40 m/s to maximum speed.

Fig. 1.2 is the speed-time graph for the motorcycle along the straight section of the track.

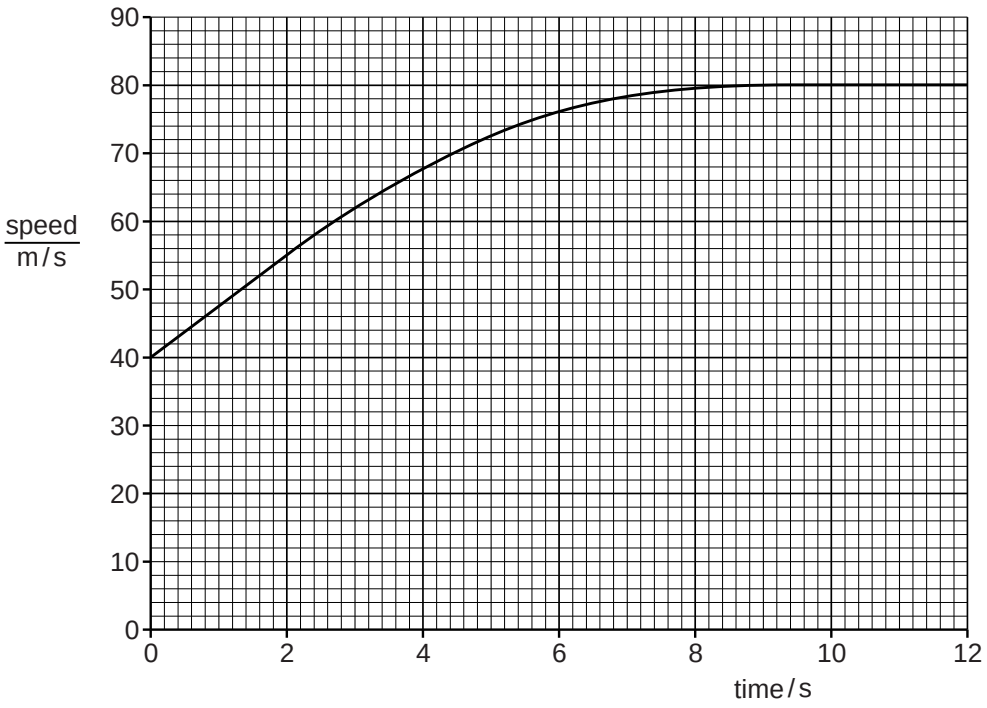

Fig. 1.2

The mass of the motorcycle is 180 kg.

(a) For the time 0 to 2.0 s, determine

(i) the acceleration of the motorcycle,

acceleration = ...[2]

(ii) the resultant force acting on the motorcycle.

force = ...[2]

(b) The driving force acting on the motorcycle remains constant throughout the 12 s spent on the straight section of track.

(i) Using Fig. 1.2, describe how the acceleration of the motorcycle changes during this time.

.....

.....[1]

(ii) Explain, in terms of the forces acting, why the acceleration changes in this way.

.....

.....

.....

.....[3]

Question # 9: Oct Nov 2015/P21/Q1

Fig. 1.1 shows an archer firing an arrow at a target during a competition.

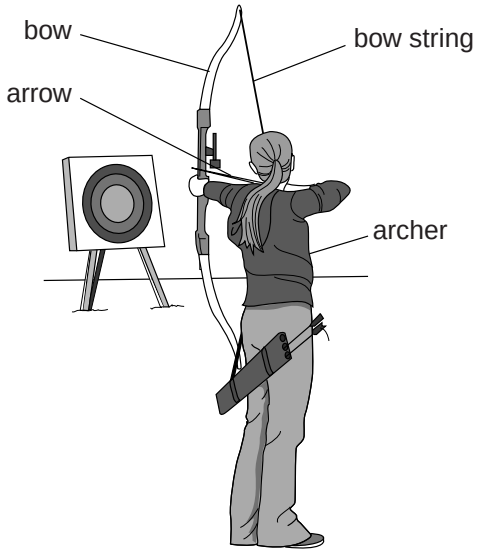

Fig. 1.1

The arrow has a mass of 0.018 kg and is initially at rest. The arrow leaves the bow 0.011 s after the bow string is released. When it leaves the bow, the velocity of the arrow is 95 m / s.

(a) Calculate

(i) the average acceleration of the arrow during the 0.011 s,

average acceleration = ... [2]

(ii) the average force exerted on the arrow during the 0.011 s.

average force = ... [2]

(b) In practice, the force exerted on the arrow gradually decreases to zero during firing.

On Fig. 1.2, sketch a possible speed-time graph for the arrow as it is being fired.

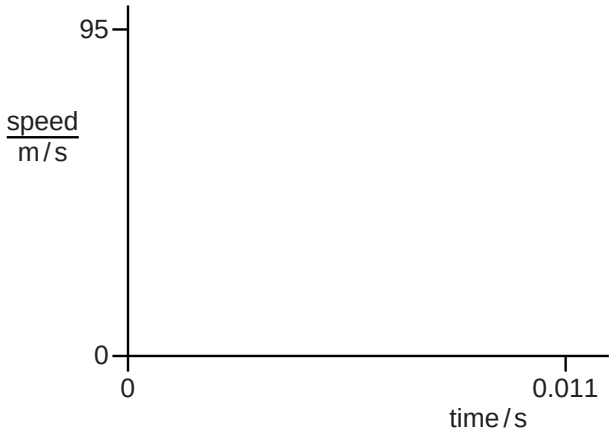

Fig. 1.2

[2]