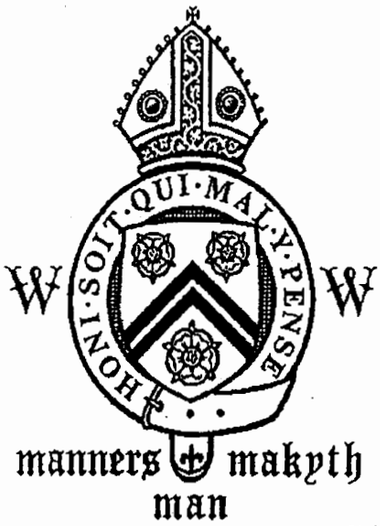
Name..... Set..... Don.....



Winchester College
Physics

3rd year Revision Test

Forces and Motion

Common Time 2010

Answer all the questions.
Total 42 marks.

Allow 40 minutes.

Remember to show your working where applicable.
Calculators are allowed.

$g = 10\ m/s^2$

For Examiner's Use

1 A large spring is repeatedly stretched by an athlete to increase the strength of his arms. Fig. 3.1 is a table showing the force required to stretch the spring.

extension of spring/m	0.096	0.192	0.288	0.384
force exerted to produce extension/N	250	500	750	1000

Fig. 3.1

(a) (i) State Hooke's law.

.....

.....[1]

(ii) Use the results in Fig. 3.1 to show that the spring obeys Hooke's law.

[1]

(b) Another athlete using a different spring exerts an **average** force of 400 N to enable her to extend the spring by 0.210 m.

(i) Calculate the work done by this athlete in extending the spring once.

work done = ...

(ii) She is able to extend the spring by this amount and to release it 24 times in 60 s. Calculate the power used by this athlete while doing this exercise.

power = ...
[4]

For Examiner's Use

2 Fig. 2.1 shows a rock that is falling from the top of a cliff into the river below.

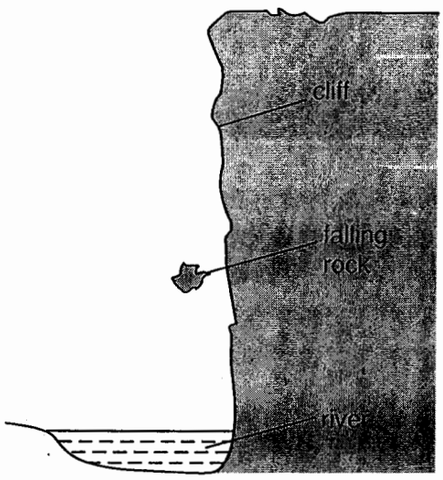


Fig. 2.1

(a) The mass of the rock is 75 kg. The acceleration of free fall is 10 m/s^2.
Calculate the weight of the rock.

weight = ...[1]

(b) The rock falls from rest through a distance of 15 m before it hits the water.
Calculate its kinetic energy just before hitting the water. Show your working.

kinetic energy = ...[3]

(c) The rock hits the water. Suggest what happens to the kinetic energy of the rock during the impact.

.....

.....

.....[3]

For Examiner's Use

3 Fig. 1.1 shows a smooth metal block about to slide down BD, along DE and up EF. BD and DE are friction-free surfaces, but EF is rough. The block stops at F.

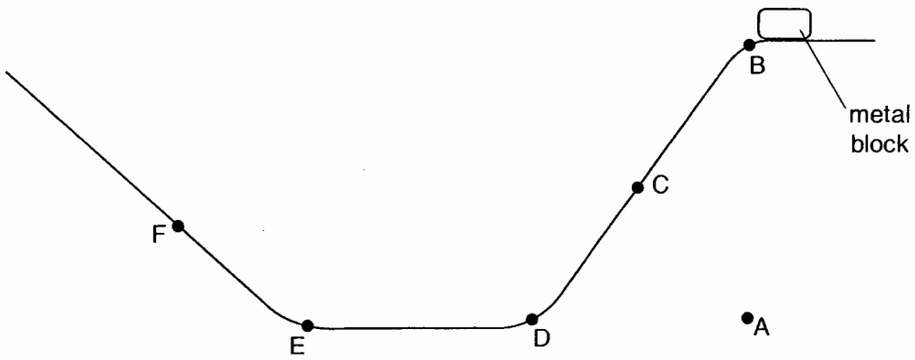


Fig. 1.1

(a) On Fig. 1.2, sketch the speed-time graph for the journey from B to F. Label D, E and F on your graph. [3]

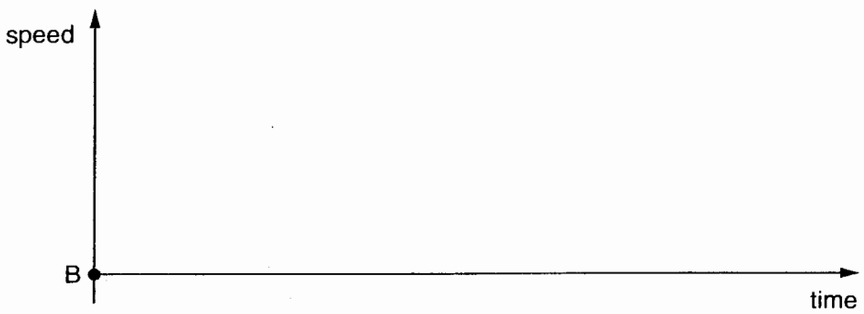


Fig. 1.2

(b) The mass of the block is 0.2 kg. The vertical height of B above A is 0.6 m. The acceleration due to gravity is 10 m/s^2.

(i) Calculate the work done in lifting the block from A to B.

work done = ...

(ii) At C, the block is moving at a speed of 2.5 m/s. Calculate its kinetic energy at C.

kinetic energy = ...
[5]

For Examiner's Use

(c) As it passes D, the speed of the block remains almost constant but the velocity changes. Using the terms *vector* and *scalar*, explain this statement.

.....

.....

.....[2]

(d) F is the point where the kinetic energy of the block is zero. In terms of energy changes, explain why F is lower than B.

.....

.....

.....

.....[3]

For Examiner's Use

4. Fig. 3.1 shows a simple see-saw. One child A sits near to end X and another child B sits near to end Y. The feet of the children do not touch the ground when the see-saw is balanced.

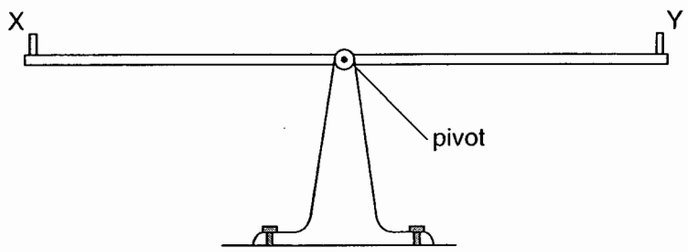


Fig. 3.1

(a) Child A has a mass of 18.0 kg and child B has a mass of 20.0 kg.

Without calculation, indicate where the children could sit so that the see-saw balances horizontally. You may draw on Fig. 3.1 if you wish.

.....

.....

..... [2]

(b) State the relationship between the moment caused by child A and that caused by child B.

.....

..... [1]

(c) Child A is 2.50 m from the pivot. Calculate the distance of child B from the pivot.

distance = ... [2]

[Turn over

For Examiner's Use

5 Fig. 2.1 shows a diver 50 m below the surface of the water.

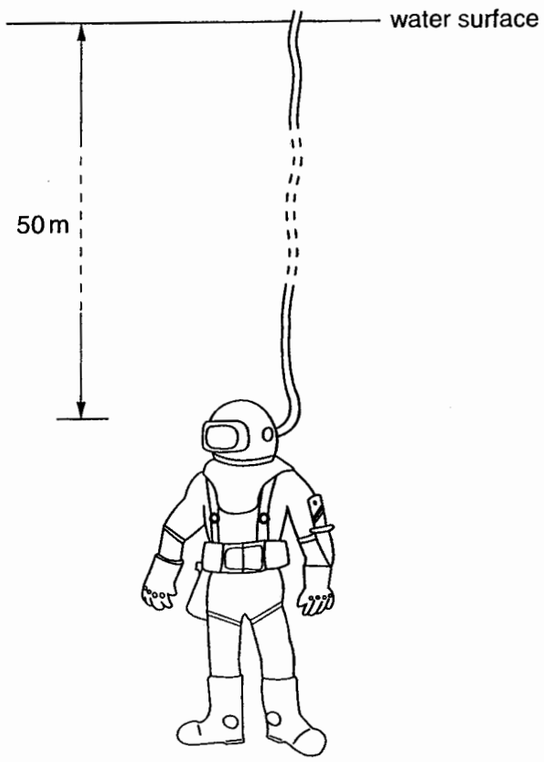


Fig. 2.1

(a) The density of water is 1000 kg/m^3 and the acceleration of free fall is 10 m/s^2. Calculate the pressure that the water exerts on the diver.

pressure = ... [3]

(b) The window in the diver's helmet is 150 mm wide and 70 mm from top to bottom.

Calculate the force that the water exerts on this window.

force = ... [3]

For Examiner's Use

6. Fig. 3.1 shows the arm of a crane when it is lifting a heavy box.

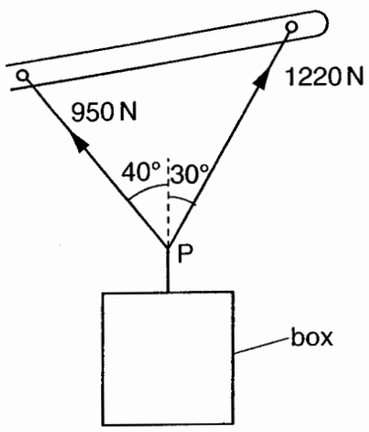


Fig. 3.1

(a) By the use of a scale diagram (**not** calculation) of the forces acting at P, find the weight of the box. [5]