*To provide an idea about what this book contains, only few pages taken randomly from the book are shown here.*

**GCE 'O' Level (Pure) Physics (Topical)**

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# Topic 3 *Force, Vector And Scalar Quantities*

## MCQ Section

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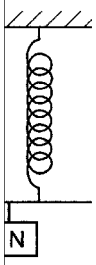


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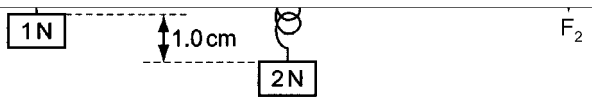


1. **C** Fact.

2. **A** The direction of the resultant force (centripetal force) acting on a body moving in a circle is towards the centre of the circle.

3. **A** Comparing the extensions produced in the same spring with a load of 1N and then with 2N, in diagram 1, it can be seen that a force of 1N produces an extension of 1cm in the spring. Using this as a scale i.e. 1N = 1cm and applying on the parallel combinations of two springs, it can be found that overall extension produced in the left system of parallel springs is 0.5cm and 1.0cm in the system on the right.

   So, $x$ = extension in the parallel system on the right – extension in the parallel system on the left = 1.0 – 0.5 = 0.5 cm.

4. **D** Applying the parallelogram law, the resultant force can be seen to be along the diagonal shown in option **D**.

5. **B** At constant speed, the resultant force acting on a body is always equal to zero.

6. **D** The electrostatic force of attraction between a positively charged nucleus and a negatively charged electron provides the centripetal force towards the nucleus for the motion of the electron around the nucleus in an atom.

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*MCQ Answers*

**7.** **C** The limit of proportionality is the point which separates the linear and the non-linear sections of the extension-load graph. The diagram shows that this point is reached with the 60 N load.

**8.** **A** The resultant force can have any value between the maximum and minimum possible values. The maximum resultant force = 30 + 50 = 80 N and the minimum resultant force = 50 – 30 = 20 N. So, the option **A** is not the possible value of the resultant force since it is less than the minimum possible value.

**9.** **D** It is a fact that a frictional force always opposes the motion of a body.

**10.** **B** The car is moving in a circle so the direction of the resultant force acting on the car is towards the centre of the circular path.

**11.** **D** The original length of the spring is 2cm. After producing the extension of 3cm the total length of the spring $=2+3=5$cm. So, the load required to obtain a total length of 5 cm can be found from the graph.

**12.** **B** 'Energy' is a scalar quantity as it has only the magnitude but no direction. Force is a vector quantity as it has a magnitude as well as a direction.

**13.** **B** The action of the propeller on water is equal to the reaction of the water on the propeller.

# Topic 3 *Force, Vector And Scalar Quantities*

## THEORY Section

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*[J01/P2/Q1]*

***Solution***

(a) Attach a horizontal needle to the bottom of the spring such that a reading can be made on the metre rule.

Extension = pointer reading with load attached with spring - metre rule reading with no load attached to spring.

(b) (i) 0.6 kg

(ii) W = mg = (0.6)(10) = 6 N

(c) The shape of the graph is unchanged but the limit of proportionality occurs at a highermass. Also the gradient of the straight section of the new graph is lower.

**COMMENT** on **ANSWER**

❝ (a) The use of the pointer reduces parallax error. Note that the pointer reading is not the same as the length of the spring since the top of the metre rule is not at the same vertical height as the top of the spring.

(b) (i) The limit of proportionality is the point between the straight and curved sections of the graph.

(c) The limit of proportionality is determined by the weight of the load rather than its mass. So to obtain the same weight in a weaker gravitational field, a larger mass must be used. Also the same mass in a weaker field results in a smaller stretching force and hence a corresponding smaller extension. ❞

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*[J02 / P2 / Q1]*

***Solution***

(a) (i) distance = speed × time = (30)(10) = 300 m

(ii) 600 N

(b) The driving force has to overcome an additional force which is the component of the weight down the slope.

(c) $a = \frac{F}{m} = \frac{-600}{800} = -0.75 \text{ m/s}^2$

deceleration = 0.75 m/s$^2$

**COMMENT** on **ANSWER**

❝(a) ii) Since velocity is constant, the acceleration of the car is 0. From the Newton's 2nd Law, the resultant force acting on the car is 0. Hence the driving force is equal to the opposing force.

(b) The resultant force acting on the car is no longer 0 since the component of the weight of the car down the slope together with the opposing force produces a total force greater than the driving force. The resultant force is now in the opposite direction of the motion of the car. ❞

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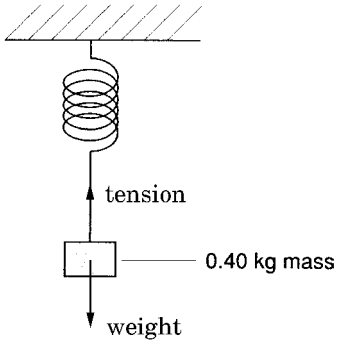
*[D05 / P2 / Q1]*

***Solution***

(a) The mass of an object is the amount of substance contained in the object.

(b) (i)




(ii) Weight = mg = (0.40)(10) = 4.0 N
Tension = Weight = 4.0 N
first force = 4.0 N
second force = 4.0 N

(c) When the mass is pulled down, the spring is stretched and its tension increases. Since the tension is now greater than the weight of the mass, there is a vertical upwards resultant force acting on the mass.

**COMMENT** on **ANSWER**

❝(b) i) The weight should be acting on the centre of gravity of the mass. Make sure both vectors have got the same length since both vectors have the same magnitude.

ii) Since the mass is at rest, the resultant force on the mass is zero. Hence the tension is equal to the weight.

(c) According to Newton's 2nd Law, an acceleration is produced by a resultant force. ❞