**Motion and energy (answers)**

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| Instructions to students  • You have 50 minutes to complete the test.  • Please answer all questions in the spaces provided.  • There is to be no talking during the test. | Marks  Section I: Multiple-choice questions: 10 marks  Section II: Short-answer questions: 35 marks  Section III: Extended-response questions: 5 marks  Total: 50 marks |

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| Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Class: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Score: /50  Grade: % |
| Comments: | |

Section I: Multiple-choice questions

For each question, circle the correct answer.

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| 1 Which line on the following graph represents a constant speed? | | CT0701_07059 |
| A | A |
| B | B |
| C | C |
| D | D |
| 2 The size of the acceleration acting on an object of mass 10 kg that has a net force of 3 N acting on it will be: | | |
| A | 3.33 m/s2. | |
| B | 30 m/s2. | |
| C | 0.3 m/s2. | |
| D | 13 m/s2. | |
| 3 An object starts from rest and accelerates at 5 m/s/s. After 4 seconds, its speed will be: | | |
| A | 0. | |
| B | 20 m/s. | |
| C | 10 m/s. | |
| D | 30 m/s. | |
| 4 The tendency of an object to resist changes in its motion is called: | | |
| A | inertia. | |
| B | friction. | |
| C | work. | |
| D | weight. | |

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| 5 When you hit a tennis ball with a tennis racquet, the action force is the force of the racquet hitting the ball and the reaction force is: | | | CT0702_07059-r |
| A | the jarring force you feel through your hand. | |
| B | the weight force on you. | |
| C | the weight force on the ball. | |
| D | the ball hitting the racquet. | |
| 6 The type of energy that involves mass, gravity and height is: | | | |
| A | kinetic. | | |
| B | gravitational potential. | | |
| C | work. | | |
| D | elastic potential. | | |
| 7 The change in position of an object and its direction is known as: | | | |
| A | average speed. | | |
| B | displacement. | | |
| C | average velocity. | | |
| D | distance. | | |
| 8 Complete the sentence: Newton’s cradle demonstrates how \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be passed from one object to another. | | CT0703_07059-r | |
| A | acceleration |
| B | action force |
| C | energy |
| D | momentum |

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| 9 At this point on the roller coaster: | |
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| A | gravitational potential energy is being transformed into kinetic energy. |
| B | gravitational potential energy is being transferred into kinetic energy. |
| C | kinetic energy is being transformed into gravitational potential energy. |
| D | kinetic energy is being transferred into gravitational potential energy. |
| 10 An object is acted upon by a thrust force of 50 N and a total frictional force of 40 N. The net force will be: | |
| A | 90 N backwards. |
| B | 90 N forwards. |
| C | 10 N forwards. |
| D | 10 N backwards. |

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|  | Section I total marks:  /10 marks |

Section II: Short-answer questions

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| 11 Describe the object’s motion for each of the speed–time graphs shown below: | |
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| a constant acceleration; positive acceleration | |
| L:\1. Publishing and Editorial\1. Product\Oxford Science\Oxford Science VICTORIA\Oxford Science 10 VIC\2. Extras\16. Class tests\Artwork\Final jpegs\CT0705_07059-r.jpg | |
| b deceleration; negative acceleration | |
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| c zero acceleration; constant speed | |
|  | /3 marks |

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| 12 Calculate the average speed of a runner who runs 500 m in 80 seconds. | |
| average speed = distance/time = 500/80 = 6.25 m/s | |
|  | /2 marks |
| 13 Which is better from a safety point of view: coming to a sudden stop or coming to a gradual stop? Explain your answer. | |
| A gradual stop (1 mark). Two marks for reasoning (time and force). A gradual stop takes more time (1 mark) and hence has less force involved (1 mark) and is therefore safer, OR a sudden stop happens in a short time and hence has a larger force involved. | |
|  | /3 marks |
| 14 Explain how the tennis ball is propelled back upwards into the air once it hits the ground. | |
| CT0804_07059-rm | |
| The ball deforms as the kinetic energy is converted into stored elastic energy. This stored elastic energy transforms to kinetic energy when the ball expands again and is propelled upwards into the air. | |
|  | /2 marks |
| 15 Calculate the distance covered by a car travelling at 25 m/s for 3 minutes. | |
| 3 minutes = 3 x 60 = 180 seconds (1 mark)  distance = speed x time = 25 x 180 = 4500 m OR 4.5 km (2 marks) | |
|  | /3 marks |
| 16 A small stone is dropped from the top of a tall building. It takes 3 seconds to reach the ground. The acceleration of the stone on the way down is 10 m/s2. Calculate the speed of the stone as it hits the ground. | |
| speed = acceleration x change in time = 10 x 3 = 30 m/s | |
|  | /2 marks |
| 17 A rock of mass 2 kg is falling through the air. A force of 5 N air resistance acts on the rock. | |
| a What is the weight force of the rock? | |
| a *W* = *m* x *g* = 2 x 10 = 20 N (2 marks) | |
| b What is the size of the net force acting on the rock? | |
| b *F*net  = 20 – 5 = 15 N (2 marks) | |

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| c What will be the size of the acceleration of the rock? | | | |
| c acceleration = *F*net/mass = 15/2 = 7.5 m/s2 (2 marks) | | | |
|  | | /6 marks | |
| 18 What is energy efficiency? Explain why energy transformations are never 100% efficient. | | | |
| Energy eﬃciency shows us how much of the total energy in an energy transformation is useable energy (1 mark). They are never 100% efficient as waste energy is always produced (1 mark), for example as heat and sound (1 mark). | | | |
|  | /3 marks | |
| 19 Complete the table to show the formula and units used for calculating acceleration, momentum, net force and speed. | | | |
| |  |  |  | | --- | --- | --- | |  | Formula | Units used | | Acceleration |  | ms–2 | | Momentum | p = mv | kg m/s | | Net force |  | N | | Speed |  | m/s | | | | |
|  | | /5 marks | |

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| 20 Calculate the net force acting on a 30 kg mass accelerating at 0.4 m/s2. | |
| *F*net *= m* × *a* = 30 × 0.4 = 12 N | |
|  | /2 marks |
| 21 The distance–displacement graph below shows a person walking north from the starting point for 5 m, west for 4 m and then walking south for 2 m.  a Use the graph to calculate their displacement  b Explain how the person’s displacement differs from the distance they walked. | |
| CT0710_07059-r | |
| Their displacement is 5 m north 53° west.  Displacement compares the start and end points of their journey (5 m) while the distance is how far they actually travelled (11 m). | |
|  | /4 marks |
|  | Section II total marks:  /35 marks |

Section III: Extended-response questions

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| 23 Use Newton’s first law of inertia to discuss why cars tilt as they turn when driving around a racetrack. | |
| CT0711_07059-rm | |
| Inertia is the tendency of an object to resist changes in its motion while it is in constant motion. An object like a car will continue in the same direction, unless it is acted upon by an outside, unbalanced force. The tilting shows the resistance in this motion. The only reason the cars change direction and turn as they move around the racetrack is due to friction from their tyres gripping the road. | |
|  | /5 marks |
|  | Section III total marks:  /5 marks |