**Motion and energy**

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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 A moving object has large amounts of: | | | |
| A | thermal energy. | | |
| B | elastic potential energy. | | |
| C | kinetic energy. | | |
| D | gravitational potential energy. | | |
| 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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| c | |
|  | /3 marks |

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| 12 Calculate the average speed of a runner who runs 500 m in 80 seconds. | |
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|  | /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. | |
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|  | /3 marks |
| 14 Explain how the tennis ball is propelled back upwards into the air once it hits the ground. | |
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|  | /2 marks |
| 15 Calculate the distance covered by a car travelling at 25 m/s for 3 minutes. | |
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|  | /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. | |
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|  | /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? | |
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| b What is the size of the net force acting on the rock? | |
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| c What will be the size of the acceleration of the rock? | |
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|  | /6 marks |
| 18 What is energy efficiency? Explain why energy transformations are never 100% efficient. | |
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|  | /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 |  | | Net force |  | N | | Speed |  |  | | |
|  | /5 marks |

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| 20 Calculate the net force acting on a 30 kg mass accelerating at 0.4 m/s2. | |
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|  | /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. | |
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|  | /4 marks |
|  | Section II total marks:  /35 marks |

Section III: Extended-response questions

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| 22 Use Newton’s first law of inertia to discuss why cars tilt as they turn when driving around a racetrack. | |
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|  | /5 marks |
|  | Section III total marks:  /5 marks |