

PART C

The questions in this part of the assignment concern some physical ideas introduced in Unit 1.

Q10 [Differentiation in the context of motion] From time $t = 0$ onwards, a particle travels along the x -axis in accordance with the position-time equation $x = At^2$, where $A = 4.0 \text{ m s}^{-2}$. How fast is the particle travelling at time $t = 10 \text{ s}$? Choose from the key the option that is closest to your answer. Pencil across one cell in row 10.

KEY for Q10

- | | |
|---------------------------|--------------------------|
| A 0.40 m s^{-1} | E 20 m s^{-1} |
| B 0.80 m s^{-1} | F 40 m s^{-1} |
| C 8.0 m s^{-1} | G 80 m s^{-1} |
| D 16.0 m s^{-1} | H 400 m s^{-1} |

Q11 [Uniform acceleration under gravity] A Ming vase falls to the ground from a shelf at height 1.8 metres above the floor. How long does it take the vase to strike the ground? Choose from the key the option that is closest to your answer. Pencil across one cell in row 11.

KEY for Q11

- | | |
|---------|---------|
| A 0.1 s | E 0.6 s |
| B 0.3 s | F 0.7 s |
| C 0.4 s | G 0.8 s |
| D 0.5 s | H 0.9 s |

Q12 [Uniform acceleration under gravity] A rocket travels vertically away from the surface of the Moon. It is still close to the Moon's surface when it jettisons an empty fuel tank. The fuel tank initially travels with the

velocity of the rocket, but it is attracted to the Moon and reaches the Moon's surface 50 s after being released, where it impacts at a speed of 50 m s^{-1} . Estimate the speed of the rocket when the fuel tank broke loose, assuming that the magnitude of the acceleration due to gravity near the Moon's surface is 1.6 m s^{-2} . Choose from the key the option that is closest to your answer. Pencil across one cell in row 12. (Hint: Think carefully about directions of motions and hence about signs.)

KEY for Q12

- | | |
|-------------------------|--------------------------|
| A 0 m s^{-1} | E 130 m s^{-1} |
| B 30 m s^{-1} | F 440 m s^{-1} |
| C 50 m s^{-1} | G 540 m s^{-1} |
| D 70 m s^{-1} | H 610 m s^{-1} |

Q13 [Applying Newton's second law in one dimension] A car of mass 1000 kg is connected to a trailer of mass 400 kg by an inextensible rope. The combined object (car plus trailer) is accelerated by a driving force of 5000 N; all other forces (such as friction and air-resistance) can be neglected. What is the tension in the rope that joins the car to the trailer? Choose from the key the option that is closest to your answer. [Hint: the driving force acts on the combined object: car + trailer. The trailer has the same acceleration as the car but is only pulled by the towing rope.] Pencil across one cell in row 13.

KEY for Q13

- | | |
|----------|----------|
| A 250 N | E 2000 N |
| B 1000 N | F 4600 N |
| C 1250 N | G 5000 N |
| D 1430 N | H 6400 N |

PART D

The questions in this part of the assignment concern some mathematical and physical ideas introduced in Unit 2.

Q14 [Differentiation, magnitude and direction of vectors] A particle moves in the x - y plane with position vector $\mathbf{r} = (At^2, Bt^4)$, where $A = 3 \text{ m s}^{-2}$ and $B = 8 \text{ m s}^{-4}$. Calculate the velocity vector of the particle at time 0.5 s, and hence find its speed and direction of motion. Choose one option from A-D that describes the particle's speed, and another option from E-H that describes its direction of motion. Pencil across two cells in row 14.

KEY for Q14

- | |
|--|
| A 4 m s^{-1} |
| B 5 m s^{-1} |
| C 8 m s^{-1} |
| D 10 m s^{-1} |
| E At 30° to the x -axis and 60° to the y -axis |
| F At 60° to the x -axis and 40° to the y -axis |
| G At 37° to the x -axis and 53° to the y -axis |
| H At 53° to the x -axis and 37° to the y -axis |

Q15 [Combining forces] A sledge of mass 30 kg rests on horizontal ground and is pulled by two ropes, as shown in Figure 5. The ropes are horizontal, are both aligned at 30° to the x -axis and both supply forces of the

same magnitude, F . Taking the coefficient of static friction between the sledge and the ground to be 0.4, calculate the minimum F that must be supplied by each rope to cause the sledge to move. Choose from the key the option that is closest to your answer. Pencil across one cell in row 15.

KEY for Q15

- | | |
|--------|---------|
| A 7 N | E 91 N |
| B 59 N | F 118 N |
| C 68 N | G 136 N |
| D 72 N | H 170 N |

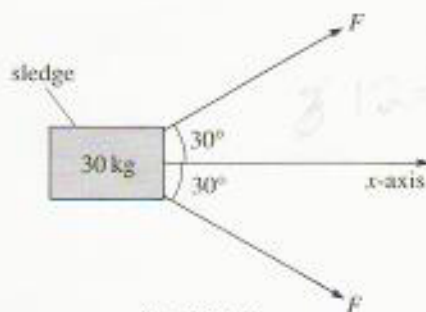


FIGURE 5 PLAN VIEW