Year 11 Physics Test NAME _____

# Linear Motion and Forces

1. Consider a bowling ball moving at a constant speed of 6.7 $ms^{-1}$ on a flat horizontal surface.

(a) Calculate the time it takes the ball to hit the pins, if the distance travelled is 18 m.

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_____ (2)

(b) Suggest how long it would take for a person to walk the same amount of distance (for example if the bowling ball became stuck and they needed to go and get it).

_____ (1)

2.

(a) Calculate the average acceleration of a Porsche that accelerates from rest (0 $ms^{-1}$) to a final speed of 21 $ms^{-1}$ over a period of 5.3 seconds.

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_____

_____ (2)

(b) Calculate the time it would take the Porsche to stop from 21 $ms^{-1}$, if it brakes with an average acceleration of 10 $ms^{-2}$.

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_____ (2)

(c) State the difference between average and instantaneous velocity.

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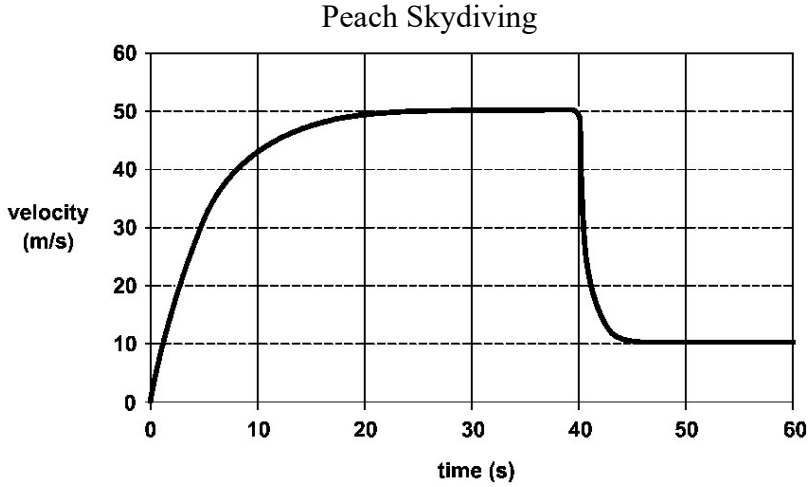
_____ (1)

3. Princess Peach goes skydiving. As she falls, she records her velocity. After she lands, she plots the results on a graph:




(a) Peach has a mass of 72 kg.

(i) Use the graph above to determine Princess Peach's instantaneous acceleration at 10 seconds.

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_____ (2)

(ii) Hence calculate the net force acting on Peach at 10 seconds.

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_____ (2)

(iii) Calculate Princess Peach's weight.

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_____ (2)

(iv) Hence determine the force of air resistance acting on Peach at 10 seconds.

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_____ (1)

(b) State why Peach's velocity suddenly drops and then levels out again at 40 seconds.

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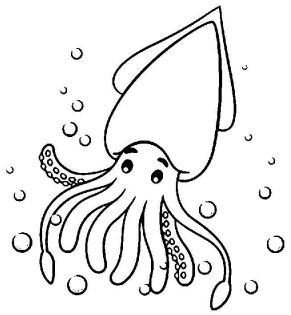
_____ (1)

4. A freshly-caught squid is dropped from 1.5 m above the ground.



Calculate the time it takes to hit the ground (with a splat).

(3)

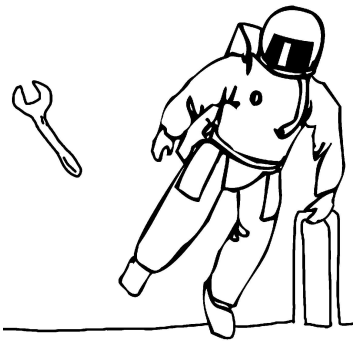
5. Calculate the maximum height reached by a ball thrown straight up at 2.3 $ms^{-1}$.

(2)

6. Explain using Newton's third law why objects on the ground experience a normal reaction force.

(2)

7. Consider an astronaut during a "spacewalk", where there is no gravity or air resistance.
The astronaut is holding onto the spacecraft but accidentally throws away his spanner.



(a) Define the word "inertia".

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_____ (1)

(b) Describe the motion of the spanner after the astronaut lets go of it.

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_____ (2)

(c) State the force pair acting when the astronaut throws the spanner.

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_____ (1)

(d) Explain, using the concept of net force, how the astronaut can avoid being accelerated.

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_____ (3)

8. An experiment was conducted to investigate the effect of mass on acceleration.

| Mass $m$ (kg) | $\frac{1}{m}$ ($kg^{-1}$) | Acceleration $a$ ($ms^{-2}$) |
|---|---|---|
| 0.10 | | 21.5 |
| 0.20 | | 8.8 |
| 0.30 | | 6.9 |
| 0.40 | | 4.5 |

a) State one factor that would need to be held constant during this experiment.

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_____ (1)

b) Complete the table by calculating $\frac{1}{m}$ for each value of $m$. (2)

c) On graph paper, plot $a$ against $\frac{1}{m}$. Include a line of best fit. (5)

d) Discuss the reliability of the data and explain why repeating and averaging measurements would improve it.

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_____ (2)

***Bonus question:***

If a projectile is launched directly upwards at speed $v$ on some planet and takes time $t$ to return to the height it was launched, derive a formula for gravity $g$ on the planet in terms of $v$ and $t$.

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_____ (3)