Name: **Date:**

1 **State** Newton's first law of motion.

2 a **State** the formula for Newton's second law that is used to calculate force.

b **State** this law expressed in terms of acceleration.

3 **Explain** why Voyager 1 (Figure 8.3.1 on page 270) is still in motion, even though its fuel ran out a long time ago.

4 In terms of Newton's first law, **explain** why having sharp objects on the dashboard of a car, or loose objects in the back, could cause injury or death in an accident.

5 **Explain** how it is possible for the car shown in Figure 8.3.8 on page 272 to be in motion, even though the net force acting on it is zero.

7 **Use** Figure 8.3.16 to **explain** how hitting the ball with a tennis racquet involves action and reaction forces.

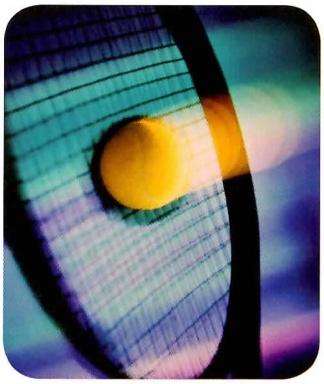

Figure 8.3.16

8 **Identify** which has greater inertia—a suitcase packed for a holiday or the same suitcase after its contents have been packed away.

9 Copy the following table and then **use** Newton's second law to **calculate** the missing values.

Net force (N)	Mass (kg)	Acceleration (m/s^2)
24.0	6.0	
13.5	3.0	
	58.0	1.5
	25.0	3.5
1160.0	80.0	
5.5		1.1

10 The mass of a Nissan GT-R is 1740 kg.

a **Calculate** the net force required for the car to travel with an acceleration of 3 m/s^2.

b If there was a 2000 N force of friction opposing the car's motion, **calculate** the size of the driving force that must be provided by the engine to maintain this acceleration.

11 **Calculate** the net force and the acceleration of each object shown in Figure 8.3.17.

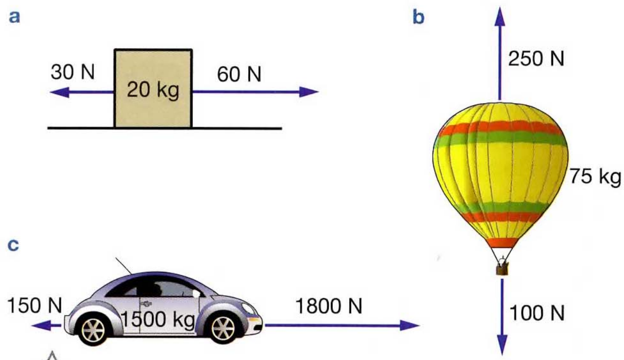

Figure 8.3.17

13 **Use** your understanding of Newton's third law to **identify** the reaction force that acts with each action force listed.

a Mylinh's foot pushes back on the footpath as she walks down the street.

b Ted applies a force to a cricket ball as he catches it.

c Sally pushes on the handle of a lawnmower.

d Alf pushes a punching bag.

e Jade pushes on pizza dough as she kneads it.

Questions 14–17 are all based on the same information.

14 Phil, a motorcyclist, takes off from rest and reaches 17 m/s in 4 seconds.

a **Calculate** what 17 m/s is in km/h.

b **Calculate** Phil's acceleration in m/s^2.

c If the mass of Phil's bike plus Phil is 190 kg, **calculate** the force required to produce this acceleration.

15 Phil's sister Yen also rides motorbikes. The mass of Yen's bike plus Yen is 150 kg. Yen can also reach 17 m/s from rest in 4 seconds. **Calculate** the force required to produce this acceleration.

16 Yen's bike weighs the same as Phil's, but is less powerful. Yen takes Phil's bike and rides away on it.

a **State** the combined mass of Yen and Phil's bike.

b Given that the driving force acting on Phil's bike is the same as the force calculated in question 14, **calculate** the size of Yen's acceleration.

c **Calculate** Yen's speed after 4 seconds.

17 As Yen has taken off with his bike, Phil is forced to use Yen's bike to try to catch up to her.

a **State** the combined mass of Phil and Yen's bike.

b Given that the driving force acting on Yen's motorbike is the same as that in question 15, **calculate** the size of Phil's acceleration.

c **Calculate** Phil's speed after 4 seconds.

18 According to Newton's second law, the acceleration of a cart of mass m being pushed with force F is $a = \frac{F}{m}$.

Ignoring any friction, **compare** the acceleration of the same cart when:

a pushed with a force $2F$

b pushed with a force $\frac{1}{2}F$

c pushed with force F but loaded up so that its mass is now $2m$

d pushed with force $2F$ and with a mass of $2m$.

Describe the different directions that your body is pushed or pulled when playing on playground equipment such as roundabouts, see-saws, swings and slides. Explain each of these sensations in terms of inertia.