Sample assessment task	
Year level	10
Learning area	Science
Subject	Physical Sciences
Title of task	Motion of a soccer ball
Task details	
Description of task	Students respond to questions which ask them to apply their understanding to discuss the motion of a ball.
Type of assessment	Test
Suggested time	40 minutes
Content description	
Content from the Western Australian Curriculum	**Science understanding** Energy conservation in a system can be explained by describing energy transfers and transformations. The motion of objects can be described and predicted using the laws of physics. **Science inquiry skills** Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations.
Achievement standard	They explain the concept of energy conservation and represent energy transfer and transformation within systems. They apply relationships between force, mass and acceleration to predict changes in the motion of objects.
Task preparation	
Prior learning	Students have learnt about forces, acceleration, velocity, energy and Newton's laws of motion.
Assessment differentiation	Teachers should differentiate their teaching and assessment to meet the specific learning needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment tasks.

Instructions to students

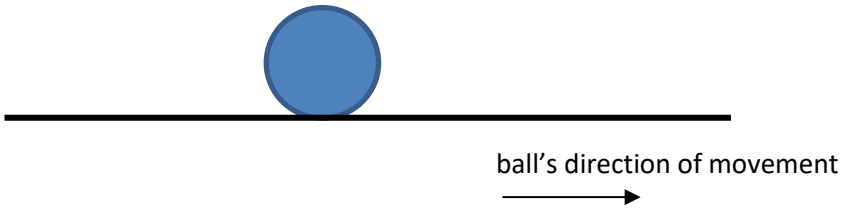
Student name: _____

Use your science understanding to fully answer the following questions.

Jenny kicks a soccer ball which is on the ground. It leaves the ground at an angle and travels in a curved (parabolic) path in the air until it hits the ground.

1. Fully describe the forces acting on the ball at the moment that Jenny kicks it. (3 marks)

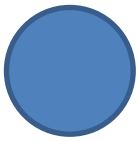
2. On the diagram of the soccer ball below, use labelled arrows to show the directions of all the forces acting on the ball at the instant that it is kicked (it will then move to the right of the page). The length of your arrows should indicate the relative sizes of the forces. (4 marks)



3. Some of the energy of Jenny's foot is not converted to kinetic energy of the ball. Where does this energy go to? (3 marks)

4. The ball leaves the ground and travels on a curved path through the air. Describe all the forces acting on the ball when it is at its maximum height. (3 marks)

5. On the diagram of the soccer ball below, use labelled arrows to show the directions of all the forces acting on the ball when it is at its maximum height (and travelling towards the right side of the page). The length of your arrows should indicate the relative sizes of the forces. (3 marks)



ball's direction of movement

6. Newton's third law of motion can be used to discuss equal and opposite reaction forces.
   Describe two instances when Jenny is kicking the ball that are examples of equal and opposite forces.
   (4 marks)

7. Use Newton's first law of motion to discuss one aspect of the ball's motion. (3 marks)

8. Use Newton's second law of motion to discuss another aspect of the ball's motion. (2 marks)

9. Jenny then throws the ball vertically so that it travels straight up and down.

   Use the following terms to fill in the table below describing the energy and velocity of the ball:
   zero, maximum, minimum, increasing, decreasing (9 marks)

Ball's position	**Just as it is being thrown**	**At maximum height**	**Travelling down towards ground**
Kinetic energy			
Potential energy			
Velocity			

10. For a ball that has been thrown vertically up, describe
    - the ball's kinetic energy for the whole flight
    - its potential energy for the whole flight and
    - the relationship between kinetic energy and potential energy for the whole flight. (7 marks)

11. For this question, consider the motion of the ball **after** it has left Jenny's hand and is travelling vertically through the air.
    Describe the acceleration acting on the ball and its effect on the ball's velocity during its flight.
    (6 marks)

Sample marking key

Description	Marks
Question 1	
Comprehensively describes the forces acting on the ball	1–3
Subtotal	**3**
Answer could include, but is not limited to: Gravity, reaction force from ground, force from the kick	[3]
Description	**Marks**
Question 2	
Vertical arrow up – labelled reaction force Vertical arrow down – labelled gravity Vertical arrows are same length Arrow to right – labelled thrust/force of kick No air resistance arrow as it is not yet moving	1–4
Subtotal	**4**
Description	**Marks**
Question 3	
Kinetic energy transforms to other forms, e.g. heat, sound	1–3
Subtotal	**3**
Description	**Marks**
Question 4	
Gravity is acting down Only other force acting is air resistance acting opposite to direction of travel 1 mark each force, 1 mark for directions	1–3
Subtotal	**3**
Description	**Marks**
Question 5	
Arrow down labelled gravity or weight Arrow to left labelled air resistance Air resistance arrow smaller than gravity arrow	1–3
Subtotal	**3**
Description	**Marks**
Question 6	
Jenny's foot applies a force to the ball, and the ball applies an equal and opposite force to her foot	1–2
Jenny's other foot applies a downward force to the ground, and the ground applies an equal and opposite force to her foot	1–2
Subtotal	**4**

<table>
<tr><th>Description</th><td>Marks</td></tr>
<tr><td colspan="2">Question 7</td></tr>
<tr><td>Comprehensively describes the inertia of the ball</td><td>1–3</td></tr>
<tr><td>Subtotal</td><td>3</td></tr>
<tr><td>Answer could include, but is not limited to:
• Force is required to overcome the ball's initial inertia
• When the ball is travelling with a particular motion it will keep travelling unless acted on by other forces. That is, the ball keeps travelling even though the initial force is no longer acting on it.</td><td>[3]</td></tr>
<tr><th>Description</th><th>Marks</th></tr>
<tr><td colspan="2">Question 8</td></tr>
<tr><td>Relates force to acceleration or mass</td><td>1–2</td></tr>
<tr><td>Subtotal</td><td>2</td></tr>
<tr><td>Answer could include, but is not limited to:
• The greater the force applied to the ball, the greater its acceleration will be
or
• The heavier the ball is, the more force will be required to accelerate it.</td><td>[1]

[1]</td></tr>
<tr><th>Description</th><th>Marks</th></tr>
<tr><td colspan="2">Question 9</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Ball's position</th><th>Just as it is being thrown</th><th>At maximum height</th><th>Travelling down towards ground</th></tr>
<tr><td>Kinetic energy</td><td>maximum</td><td>zero</td><td>increasing</td></tr>
<tr><td>Potential energy</td><td>zero</td><td>maximum</td><td>decreasing</td></tr>
<tr><td>Velocity</td><td>maximum</td><td>zero</td><td>increasing</td></tr>
</table>
1–9
</td></tr>
<tr><td>Subtotal</td><td>9</td></tr>
<tr><th>Description</th><th>Marks</th></tr>
<tr><td colspan="2">Question 10</td></tr>
<tr><td>Comprehensively describes kinetic and potential energy during the flight</td><td>1–6</td></tr>
<tr><td>Describes the relationship between Ep and Ek</td><td>1</td></tr>
<tr><td>Subtotal</td><td>7</td></tr>
<tr><td>Answer could include, but is not limited to:
• Kinetic energy: starts at maximum as it leaves the hand, decreases to zero at maximum height, increases as it travels down
• Potential energy: starts at a minimum (or zero), increases as it gains height, decreases as it travels down
• E_p and E_k are inversely proportional; as one increases, the other decreases</td><td>[3]

[3]

[1]</td></tr>
</table>

Description	Marks
Question 11	
Acceleration is due to gravity Acceleration is towards the ground As ball travels up the acceleration is negative (in opposite direction to travel) So ball is slowing down to zero vertical velocity at maximum height When ball travels down the acceleration is in same direction as travel. So ball speeds up as it travels towards the ground	1–6
Subtotal	**6**
Total	**47**