Hurst Science
Year 7 Physics

Forces and Motion Test

Time Allowed: 35 minutes

- The answers should be written on the question paper.
- Attempt all of the questions 1 – 7 (question 8 is optional)
- Calculators and rulers may be used.

Name: MARKSCHEME

Teacher:_____________________

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>/33 (+6*)</th>
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<td>Grade</td>
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<td>CG</td>
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<thead>
<tr>
<th>Reflection</th>
<th>Preparation</th>
<th>Continuous Improvement</th>
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<tbody>
<tr>
<td>What have you done well in?</td>
<td>What could you have worked on more?</td>
<td>Set yourself a target for improvement.</td>
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Q1.

(a) Megan's dog is pulling on his lead. Which arrow, A, B, C or D, shows the direction of this force? Give the letter.

\[ \text{\underline{B}} \]  

1 mark

(b) Megan has to pull to keep the dog still. Which arrow shows the direction of this force? Give the letter.

\[ \text{\underline{D}} \]  

1 mark

(c) Suddenly the dog's collar breaks.

(i) When the collar breaks, the lead moves. Draw an arrow on the diagram to show which way the lead starts to move.

1 mark

(ii) Why does the lead move when the collar breaks?

\[ \text{\underline{resistant force to left}} \]

\[ \text{\underline{unbalanced force (to left)}} \]  

1 mark

Maximum 4 marks
Q2. The diagram shows four forces acting on a plane in flight.

(a) Which arrow represents air resistance?
Give the letter.

\[ \text{B} \]

1 mark

(b) (i) When the plane is flying at a constant height, which two forces must be balanced?
Give the letters.

\[ \text{A and C} \]

1 mark

(ii) When the plane is flying at a constant speed in the direction shown, which two forces must be balanced?
Give the letters.

\[ \text{B and D} \]

1 mark

(c) (i) Just before take-off, the plane is speeding up along the ground.
Which statement is true?
Tick the correct box.

- Force B is zero.  
- Force B is greater than force D.  
- Force D is equal to force B.  
- Force D is greater than force B.  

\[ \checkmark \]

1 mark
(ii) Which statement is true about the plane just as it leaves the ground?
Tick the correct box.

- Force C is zero.
- Force C is greater than force A.
- Force A is equal to force C.
- Force A is greater than force C.

1 mark
maximum 5 marks
Q3. Speed cameras are used to detect motorists who break the speed limit. A number of lines 2 m apart are painted on the road. As a speeding car crosses the painted lines, the camera takes two photographs, 0.5 s apart.

(a) (i) How far did the car move between the two photographs?
Give the correct unit.

\[
\text{8 lines } \pm 1 = 16 \text{ m (} \pm 2 \text{)}
\]

1 mark

(ii) How fast is the car in the photographs moving?

\[
\frac{s}{t} = \frac{16}{0.5} = 32 \text{ m/s}
\]

→ accept correct answer for distance in (a) as ecf.

2 mark

(b) It takes 0.0002 s to take each photograph.
How far does the car move while the speed camera is taking one photograph?

\[
d = s \times t
\]

\[
= 32 \times 0.0002
\]

\[
= 0.0064 \text{ m (} 6.4 \times 10^{-3} \text{ m)}
\]

\[\text{x awow ecf for speed calculated in (ii)}\]

2 mark

Total 5 marks
Q4. The photographs below show pupils investigating the movement of objects on ramps.

Plan an investigation into the factors affecting the movement of objects on ramps.

You can use any objects and any surfaces you like, and any other equipment you need.

In the box below, write a short draft of one question you could plan to investigate about the movement of objects on ramps.

Use your draft to help you answer the following questions.

(a) Give one factor you could change as you carry out your investigation (the independent variable).

- Height of ramp
- Type of surface
- Weight of object

1 mark
(b) What factor would you observe or measure to collect your results (the dependent variable) and what equipment would you use to measure them?

The factor I would observe or measure is

- speed
- force
- time

* accept sensible answer.

1 mark

The measuring equipment I would use is

equipment to match above.

1 mark

(c) Give one factor you should keep the same to make your test fair.

sensible answer for investigation

- e.g. mass of object / height of ramp /

1 mark

maximum 4 marks
Q5.

(a) A railway engine is being used to try to pull a wagon along a level track. The wagon's brakes are on, and the wagon does not move.

(i) Draw one arrow on the diagram to show the direction of the force which prevents the wagon from moving.

(ii) Is the force which prevents the wagon from moving greater than, equal to or less than the pull of the engine?

(b) (i) When the wagon's brakes are off, the engine pulls the wagon forwards. A frictional force also acts on the wagon. In what direction does the frictional force act?

(ii) The pull of the engine is 5000 N. When the wagon's speed is increasing, how large is the frictional force? Tick the correct box.

- zero
- between 0 and 5000 N
- 5000 N
- more than 5000 N

1 mark
(c) After a while, the wagon travels at a steady speed. The engine is still pulling with a force of 5000 N.

How large is the frictional force now?
Tick the correct box.

- zero
- between 0 and 5000 N
- 5000 N
- more than 5000 N

1 mark
Maximum 5 marks
Q6. A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.

(a) What was the distance of the race?

\[ \text{distance} = 60 \text{ km} \]

(b) How long did it take the horse and rider to complete the race?

5.5 hours ± 0.1 (blurry graph)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance = 30 km

(d) How long did the horse and rider stop and rest during the race?

30 minutes 0 hours (± 0.1)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

D and E

Give a reason for your answer.

→ Line is least steep

→ Smallest gradient

→ Accept correct calculation at speed at this point (e.g. \( \frac{5}{18} = 3.3 \text{ km/h} \))

(Total 6 marks)
Nazia is investigating how easily a block of wood slides along a wooden bench. The diagram shows her experiment.

(a) Nazia does the experiment with different weights on top of the block. She counts how many slotted masses she needs to hang from the string to make the block of wood slide. Her results are shown in the table.

<table>
<thead>
<tr>
<th>weight on top of the block in N</th>
<th>number of slotted masses needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
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<td>4</td>
<td>13</td>
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(i) Describe how the number of slotted masses needed to move the block varies with the weight on top of the block.

...the larger the weight, the more masses are needed to move the block...  

(ii) Nazia does the experiment with a weight of 3.5 N on top of the block of wood.

How many slotted masses would she need to make the block slide?

12

1 mark
(b) Nazia does her experiment again. This time she slides the block of wood over a sheet of glass instead of the bench top.

(i) Suggest how her results would be different this time.

less masses needed

1 mark

(ii) Using the same sheet of glass and block of wood, and keeping the same weight on top, suggest one way Nazia could reduce the force of friction.

→ acid water to glass

→ rub block so less surface area in contact with surface

→ accept reasonable answers.

1 mark

Maximum 4 marks
STRETCH QUESTION [A* Level]

Only attempt this question if you have finished and checked the rest of the question papers.

Q8* A student investigated how the extension of a spring depends on the force applied to the spring.

The diagram shows the spring before and after a force had been applied.

(a) (i) Complete the following sentence using letters, A, B, C or D, from the diagram.

The extension of the spring is the distance between the positions labelled

B ...................................................... and ...................................................... on the metre rule.

(ii) What is the name of the force acting upwards on the mass?

.................................................................

(1)
(b) The results from the investigation are plotted on the following graph.

(i) The graph shows that the student has made an error throughout the investigation.

What error has the student made?

measured length (not extension)

Give the reason for your answer.

extension should start from zero (OE)

(ii) The student has loaded the spring beyond its limit of proportionality.

Mark on the graph line the elastic limit of the spring. Label the point P.

Give the reason for choosing your point P.

⇒ no longer a straight line
⇒ force and extension are no longer (directly) proportional

(Total 6 marks)
[END OF QUESTION PAPER]