AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.5.1.3 GRAVITY (PACK 1)

SCORE	PERCENTAGE
/78	%

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Q1.

(a) equal to

1

(b) weight = 85 × 9.8

1

weight = 833 (N)

allow weight = 830 (N)

1

*an answer of 833 (N) **or** 830 (N) scores **2** marks*

(c) work done = 833 × 0.63

*allow their calculated value from part **(b)** × 0.63*

1

work done = 525 (J)

*allow an answer that is consistent with their calculated value from part **(b)***

1

*an answer that rounds to 525 (J) scores **2** marks*

(d) work done = 0 (J)

1

(e) force = 62 × 11

1

force = 682 (N)

allow force = 680 (N)

1

*an answer of 682 (N) **or** 680 (N) scores **2** marks*

[8]

Q2.

(a) 870 000 × 36

1

31 320 000 (J)
or
3.1×10^7 (J)

allow 31 000 000 (J)
***or** 31 300 000(J))*

1

*an answer 31 320 000 (J) scores **2** marks*

(b) some energy was wasted / dissipated

allow efficiency is always less than 100%

1

(and) transferred to thermal energy

1

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(c) 27 (%)

1

(d) **similarity**

any **one** from:

- contain same amount of aluminium
- contain (very) similar amounts of silicon

*ignore same amount of silicon unless their answer to part **(c)** was 28%*

- oxygen makes up the highest percentage

allow both contain aluminium, iron, oxygen and silicon

1

difference

any **one** from:

- Moon rock contains more iron (than Earth rock)
- Moon rock contains less oxygen (than Earth rock)
- Moon rock contains less silicon (than Earth rock)

*allow ecf from part **(c)***

1

*do **not** allow 2 marks for silicon as both similarity and difference*

(e) scientists discover new evidence which the existing theory cannot explain

1

(f) gravitational potential energy = mass × gravitational field strength × height

allow $E_p = mgh$

1

(g) 86 000 000 = 2150 × 1.6 × h

1

$$(h =) \frac{86\,000\,000}{2150 \times 1.6}$$

1

(h =) 25 000 (m)

1

*an answer 25 000 (m) scores **3** marks*

[12]

Q3.

(a) the arrows have different lengths

allow forces can have different sizes

1

the arrows point in different directions

allow forces can have different directions

1

(b) **D**

1

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(c) **B**

1

(d) both variables are continuous

1

(e) it is moving at a constant velocity

1

(f) 24.5 (m/s^2)

1

(g) 5 g = 49 (m/s^2)

1

49 m/s^2 > 24.5 m/s^2

1

so the ride is safe

allow ecf from (f) (ie if their answer to (f) was greater than 49, then the ride is unsafe)

1

(h) force = 58 × 24.5

allow ecf from (f)

1

force = 1421

1

Newtons

allow N

1

[13]

Q4.

(a) arrow of equal size pointing vertically downwards

judged by eye

1

labelled 'weight'

1

(b) the upwards force is greater than the downwards force

1

because air resistance increases

1

(c) $v^2 = (2 \times 2 \times 209) + 8^2$

1

$v = \sqrt{900}$

1

v = 30 (m / s)

1

*allow 30 (m / s) without working shown for **3** calculation*

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marks

(d) vertical force (300 N) drawn with a suitable scale

1

horizontal force (60 N) drawn to the same scale

1

resultant force drawn in correct direction

1

value of resultant in the range 304 N – 308 N

1

[11]

Q5.

(a) Has direction and magnitude

1

(b) 5.5

1

(c) 6.4 ÷ 9.8 = 0.65 (kg)

1

(d) the Earth's gravitational field strength is 2.5 times greater

allow the gravitational field strength on Earth is greater than on Mars

1

[4]

Q6.

(a) Gravity

1

(b) Mass of marble

1

(c) Drop height

1

(d) 31 (cm)

1

(e) the result was anomalous

allow the result was too different from the other values

1

(f) increasing the drop height increases the roll height

1

(g) energy losses (due to friction)

allow air resistance, friction, drag

1

[7]

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Q7.

(a) weight = mass × gravitational field strength

1

(b) mass = weight ÷ g

1

= 1.4 ÷ 9.8

1

= 0.143 (kg)

*allow 0.143 with no working shown for **3** marks*

1

(c) momentum = mass × velocity

momentum before = momentum after

1

143 × 7.9 = 150 × v

1

$v = \frac{143 \times 7.9}{150}$

1

= 7.5 (m / s)

*allow 7.5 (m / s) with no working shown for **4** marks*

1

*incorrect number of sig. figs max. **3** marks*

(d) ball is falling / moving down

1

at terminal velocity

1

air resistance and weight have the same magnitude / size

1

so no acceleration / constant speed

1

[12]

Q8.

(a) 600 kg = 5880 N

1

$\text{power} = \frac{5880 \times 35}{45}$

1

= 4573.3 (W)

*this step without the previous steps stated gains **3** marks*

1

$\% \text{ Eff.} = \frac{4573.3}{8000} \times 100$

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1

= 57.17 (%)

*allow 57.17 with no working shown for **5** marks*

1

(b) gpe = 600 × 9.8 × 35

1

= 205 800

1

gpe = KE = ½ m v^2

1

$v = \sqrt{\frac{2 \times kE}{m}}$

1

$= \sqrt{\frac{411\,600}{600}}$

1

= 26.2 (m / s)

*allow 26.2 with no working shown for **6** marks*

1

[11]

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Q1.

(a) Only 21% identified the downwards force of the man on the bar as being equal to the upwards force of the bar on the man. Many believed it to be more than.

(b) Nearly 90% of students were able to substitute the correct numbers into the given equation and calculate the correct value of weight.

(c) 68% took their answer from part **(b)** and multiplied by 0.63 m to obtain the correct answer for work done. Many incorrect answers were given when students used 9.8 N/kg × 0.63 m and a significant minority multiplied the part **(b)** by 0.32 m.

(d) Just over 40% demonstrated they understood that when the man was not moving the work done would be 0 J. Many put in their calculated values from other parts of the question.

(e) 85% gained two marks with most students able to substitute the correct numbers into the equation given.

Q2.

(a) Around three quarters of students gained the two marks for this calculation.

10% did not attempt it, and a small number of students divided the two given numbers.

Some students worked out the correct answer, then divided by 1000, possibly because the answer of 31 320 000 J looked very large.

(b) Around one quarter of students did not attempt this question. Few realised that this was a question about useful and wasted energy and only 6% gained both marks. Those who scored one mark tended to get it for the mention of thermal / heat energy.

A common incorrect response was to refer to the energy being ‘lost’ rather than ‘wasted’. Many seemed to think that the Moon’s gravity affected how the energy from the batteries was transferred to kinetic energy.

(c) Around 6% of students did not attempt this question. Around one third gave the correct value of 27%.

A fairly common incorrect answer was 73%, where the given values had been added, but not subtracted from 100.

There were a large number of answers in the region of 27, indicating that students knew what to do but either added the values together incorrectly or subtracted from 100 incorrectly. In some cases, working was shown which confirmed this.

(d) 12% of students did not attempt this question. Around one third of students were able to correctly identify both a similarity and a difference from the table, the majority choosing the aluminium and iron percentages respectively.

Despite the instruction to use the table of data, many students stated similarities and differences in texture, hardness, gravity, colour, density, etc. Such answers gained

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no marks.

Some students, although using the table, did not score marks because they did not 'add value' to the data. This was relevant for the 'difference' mark, where a qualitative description of the difference was required. For instance, an answer or 'iron' or 'iron is different' did not gain a mark, whereas 'Moon rock contains a higher percentage of iron' did.

(e) Around 85% of student responses were correct. Responses for the incorrect options were fairly evenly spread, with 'scientists change their theories to make the theories more popular' being chosen more than the other two.

(f) This was the first occasion in this paper where an equation had to be recalled. Nearly one third of students left this blank.

Of those who wrote something, some wrote an equation which was totally unconnected to the quantities listed. Some wrote expressions which were not equations, i.e. did not have an equals sign. Some wrote equations in the form of chemical equations, e.g. gravitational potential energy + mass ⟶ gravitational field strength + height.

Of those who wrote a mathematical equation connecting the given quantities, less than 20% gave a correct form of the equation to gain the mark.

(g) More than one quarter of students left this blank, which tied in with the fact that many had left the previous question blank because they did not know the gravitational potential energy equation.

Of the students who attempted this calculation, many had difficulty manipulating an equation linking four quantities. Many combinations of the given values were seen, the most popular being to multiply the energy value by one of the other two quantities and then divide by the third. Some students took all three numbers, or just two of them and multiplied them together.

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