Energy Stores and Changes

Mark Scheme

Name: _____

Class: _____

Date: _____

Time: **76 minutes**

Marks: **75 marks**

Comments:

Mark schemes

1 (a) gravity

accept weight for gravity

air resistance is insufficient

1

(b) (i) 800

*allow **1** mark for correct substitution ie*

$$P = \frac{2240}{2.8}$$

provided no subsequent step

2

(ii) 2240 J

1

(c) (i) (vertical) height

accept (height of) stairs

1

(ii) a fast / short time (for a lighter student) may give the greatest power

accept time is a factor

or

a slow / long time (for a heavy student) may give the least power

fitness is insufficient

1

[6]

2 (a) any **two** from:

- bungee rope may snap
- rope may extend too much
- student may land in the river

2

(b) gravitational potential

correct order only

1

kinetic

1

elastic potential

1

(c) ½ × 40 × 35^2

1

24 500 (J)

accept 25 000 (J) (2 significant figures)

1

*allow 24 500 (J) with no working shown for **2** marks*

[7]

3 (a) kinetic energy = 0.5 × mass × $speed^2$

allow $E_k = 1/2\ mv^2$

1

(b) $E_k = 0.5 \times 0.058 \times 5^2$

1

$E_k = 0.725$ (J)

*an answer of 0.725 (J) scores **2** marks*

1

(c) 0.725 (J)

allow ecf from (b)

allow the same amount of E_k as at A

1

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

allow Ep = mgh

1

(e) $0.38 = 0.058 \times 9.8 \times h$

1

$$h = \frac{0.38}{(0.058 \times 9.8)}$$

1

h = 0.67 (m)

*an answer that rounds to 0.67 scores **3** marks*

1

[8]

4

(a) (i) kinetic (energy)

allow gravitational potential (energy) / gpe

movement is insufficient

1

(ii) dissipates into the surroundings

allow warms up the surroundings / air / motor

accept lost to the surroundings

accept lost as heat

ignore reference to sound

it is lost is insufficient

1

(b) energy (required) increases with load

accept positive correlation

*do **not** accept (directly) proportional*

1

further amplification eg increases slowly at first (or up to 4 / 5 N), then increases rapidly

simply quoting figures is insufficient

an answer that only describes the shape of the line gains no marks

1

(c) (i) $E = P \times t$

2880

*accept £28.80 for all **3** marks*

*an answer £2880 gains **2** marks*

*allow **1** mark for obtaining 48 h **or** converting to kW*

*allow **2** marks for correct substitution*

ie 4 × 48 × 15

note: this substitution may be shown as two steps

*an answer 2 880 000 gains **2** marks*

*an answer £4.80 / 480 gains **2** marks*

*an answer of 192 (ie calculation of energy without subsequent calculation of cost) gains **1** mark)*

3

(ii) any sensible suggestion eg

conserves fossil fuels

less (fossil) fuels burned

less pollutant gas (produced)

accept a named pollutant gas

less greenhouse gas (produced)

saves energy is insufficient

1

[8]

5 (a) gravitational potential

1

kinetic

1

chemical

1

(b) flying drones may damage aircraft
or
falling drones may injure people
or
damage buildings / vehicles

allow any sensible suggestion of a hazard caused by a flying / falling drone

1

(c) energy transferred = power × time

allow $E = Pt$

1

(d) t = 25 × 60 = 1500 (s)

1

E = 65 × 1500

1

E = 97 500 (J)

an answer of 97 500 (J) scores 3 marks

allow 2 marks for an answer of 1625 (J)

1

[8]

6 (a) 13 500 (J)

*allow **1** mark for correct substitution, ie 90 x 10 x 15 provided no subsequent step shown*

2

(b) 17

or

$\sqrt{\frac{\text{their (a)}}{45}}$

correctly calculated and answer given to 2 or 3 significant figures

accept 17.3

*allow **2** marks for an answer with 4 or more significant figures, ie 17.32*

or

*allow **2** marks for correct substitution, ie 13 500/ their (a) = ½ x 90 x v^2*

or

*allow **1** mark for a statement or figures showing KE = GPE*

3

(c) work is done

1

(against) friction (between the miner and slide)

*accept 'air resistance' **or** 'drag' for friction*

1

(due to the) slide not (being perfectly) smooth

accept miners clothing is rough

or

causing (kinetic) energy to be transferred as heat/internal energy of surroundings

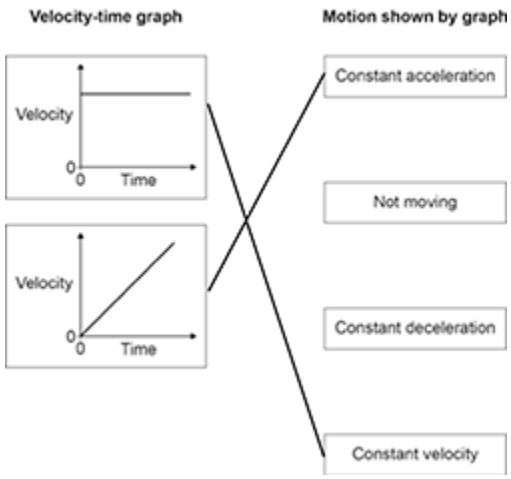
accept lost/transformed for transferred

accept air for internal energy of surroundings

1

[8]

7 (a)



*if more than one line is drawn from a graph then all those lines are wrong allow **1** mark for 1 correct line*

2

(b) speed

1

(c) (i) 2.25

*allow **1** mark for correct substitution i.e.*

$a = \frac{9 - 0}{4}$ or $a = \frac{9}{4}$

provided no subsequent step

2

(ii) the air resistance increases

1

(d) 2000 J

1

mass is half
or
kinetic energy depends on mass

*do **not** accept weight for mass*

1

[8]

8 (a) g.p.e. = mass × gravitational field strength × height

accept $E_p = mgh$

1

(b) $E_p = 50 \times 9.8 \times 20$

1

9800 (J)

*allow 9800 (J) with no working shown for **2** marks*
answer may also be correctly calculated using W = Fs
*ie allow W = 490 × 20 for **1** mark*
*or answer of 9800 (J) using this method for **2** marks*

1

(c) 7840 (J)

allow ecf from '11.2'

1

(d) $7840 = ½ \times 50 \times v^2$

1

$$v = \sqrt{\frac{7840}{1/2 \times 50}}$$

allow $v^2 = \frac{7840}{(1/2 \times 50)}$ *for this point*

1

17.7(0875) (m / s)

1

18 (m / s)

*allow ecf from '11.3' correctly calculated for **3** marks*
*allow 18 (m / s) with no working for **2** marks*
answer may also be correctly calculated using $v^2 - u^2 = 2as$

1

(e) extension = 35 (m) and conversion of 24.5 kJ to 24500 J

1

$24\,500 = ½ \times k \times 35^2$

1

40

1

*allow 40 with no working shown for **3** marks*
*an answer of '16.2' gains **2** marks*

[11]

9 (a) (i) decreases (to zero)

1

resultant force acts in opposite direction to motion

accept air resistance and weight for resultant force
accept resultant force acts downwards
*do **not** accept air resistance increases*

1

(ii) velocity includes direction
or
velocity is a vector (quantity)

1

(b) (i) 3.6

allow 1 mark for correct substitution i.e.

½ × 0.05 × 12^2 provided no subsequent step

2

(ii) 3.6 **or** their (i)

1

(iii) 7.2

or

their (ii) ÷ 0.5 correctly calculated

*allow **1** mark for correct substitution i.e.*

3.6 or their (ii) = 0.05 × 10 × h

2

(iv) **B**

1

(c) range increases up to 45°

1

range decreases from 45°

the range is a maximum at 45° gains both marks

for any two angles that add up

to 90° the range is the same gains both marks

*the range increases then decreases gains **1** mark*

1

[11]