

Q1.(2018)

a)

chemical

equal to

b)

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

c)

$$200 = \frac{W}{1800}$$

$$W = 200 \times 1800$$

$$W = 360\,000 \text{ (J)}$$

d)

$$11 - 9.5 = 1.5 \text{ (m/s)}$$

$$\left(\frac{1.5}{9.5}\right) \times 100 = 15.8 \text{ (\%)}$$

e)

maximum speed is lower

because maximum power output
of cyclist is constant

(but) additional work is done
(against gravity)

or

gravitational potential energy (of
cyclist) is increased

Q2.(2019)

a)

$$41 = \frac{9.8 \times h}{0.12}$$

$$h = \frac{41 \times 0.12}{9.8}$$

$$h = 0.50 \text{ (m)}$$

b)

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

or

$$E_k = \frac{1}{2} mv^2$$

c)

$$270 = \frac{1}{2} \times m \times 3^2$$

$$m = \frac{270}{(\frac{1}{2} \times 3^2)}$$

or

$$m = \frac{270}{4.5}$$

$$m = 60 \text{ (kg)}$$

d)

- males have a greater muscle power than females for most of their lives
- males have a greater muscle power than females above 9/10 years old
- males have a lower muscle power than females below 9/10 years old
- there is a similar pattern for males and females as age increases
- males have a peak muscle power at 25 years old whereas females have a peak muscle power at 20/21 years old
- at 9/10 years old males have the same muscle power as females
- peak muscle power for males (47 W/kg) is greater than peak muscle power for females (37 W/kg)
- the rate of increase of muscle power is greater for males than females (between 5 and 25 years old)
- the rate of decrease of muscle power is greater for males than females.

e)

any **1** from:

- maximum height reached is a better indicator of maximum muscle power
- maximum / peak muscle power was being investigated, not mean / average muscle power
- volunteer may not use maximum effort on the first try
- performance may improve with practise
- performance may get worse with tiredness

Q3.(2019)

a)

$$1470 = 60 \times 9.8 \times h$$

$$h = \frac{1470}{60 \times 9.8}$$

or

$$h = \frac{1470}{588}$$

$$h = 2.5 \text{ (m)}$$

b)

(work done against) air resistance

or

(work done against) friction
(between zip line and pulley)

causes thermal energy to be transferred to surroundings

c)

different people have different
surface areas

so would be affected by air
resistance differently

OR

initial speed may not be zero (1)

which would add to the total
energy (of the system) (1)

Q4.(2020)

a)

Length of sled

Time for sled to pass light gate

b)

$$E_p = 8330 \text{ (J)}$$

$$8330 = m \times 9.8 \times 17.0$$

$$m = \frac{8330}{9.8 \times 17.0}$$

$$m = 50.0 \text{ (kg)}$$

c)

$$\frac{1}{2} mv^2 = mgh$$

or

decrease in E_p = increase in E_k

masses cancel on both sides of
the equation

or

$$v^2 = 2gh$$

(final) speed only depends on
vertical height (and gravitational
field strength)

variations will be due to air
resistance/friction

or

different initial speed

Q5.(2022)

a)

$$h = 1.75 \text{ (m)}$$

$$E_p = 60 \times 9.8 \times 1.75$$

$$E_p = 1029 \text{ (J)}$$

$$P = \frac{1029}{1.40}$$

$$P = 735 \text{ (W)}$$

b)

girl increases her kinetic energy
(as well as increasing her
gravitational potential energy)

some energy is wasted in her
muscles

or

some energy transferred as
thermal energy (to
surroundings)

c)

the boy's mass was greater than
the girl's mass

Q6.(2023)

a)

$$E_p = 367\,500\,000 \text{ (J)}$$

$$367\,500\,000 = 2\,500\,000 \times 9.8 \\ \times h$$

$$h = \frac{367\,500\,000}{2\,500\,000 \times 9.8}$$

$$h = 15 \text{ (m)}$$

b)

$$3 \text{ kW} = 3000 \text{ W}$$

$$3000 = \frac{2.16 \times 10^7}{t}$$

$$t = \frac{2.16 \times 10^7}{3000}$$

$$t = 7200 \text{ (s)}$$

$$t = 7.2 \times 10^3 \text{ (s)}$$

c)

in the summer the power output from the hydroelectric generator is lower but the solar power output would be greater

so less variation in total power output (which improves the reliability of the supply)

Q7.(2023)

a)

spring may become permanently extended

or

extension of the spring may be too great (so the baby's feet are always on the floor)

b)

(in position **A**) the baby has gravitational potential energy

(as the baby moves down this) is transferred to kinetic energy (of the baby) and / then elastic potential energy (of the spring)

(in position **B**) all the energy is elastic potential energy

c)

$$e = 0.080 \text{ (m)}$$

$$4.0 = \frac{1}{2} \times k \times 0.080^2$$

$$k = \frac{4.0}{(0.5 \times 0.080^2)}$$

$$k = 1250 \text{ (N/m)}$$

Q8.(2024)

a)

thermal / internal (energy)

or

kinetic (energy of the water particles)

Q8.b)(2024)

gravitational potential (energy)

c)

Method A:

- heated water needs insulating (to maintain high temperature)
- energy stored by heating water is much greater (per 100 kg)
- useful energy from heating 100 kg of water = 20 160 (kJ)
- energy wasted (per 100 kg) = 13 440 (kJ)
- efficiency = 60 %

Method B:

- suitable location needed to pump water uphill
- pumping water efficiency is higher
- useful energy from pumping 100 kg of water = 367.5 (kJ)
- energy wasted (per 100kg) = 122.5 (kJ)
- efficiency = 75 %

Q8.d)(2024)

Transport examples:

don't use (petrol / diesel) cars
(for transport)

or

don't burn petrol / diesel (for
transport)

(instead) use electric cars

or

(instead) use hydrogen-fuelled
cars

or

(instead) use a bicycle

or

(instead) use public transport

or

(instead) walk

Generating Electricity

examples:

don't use coal / oil / gas (to
generate electricity)

(instead) use renewable
methods

or

(instead) use nuclear power

OR

don't use (electrical) appliances
when not needed

to reduce the demand for
electricity (generated) using coal
/ oil / gas

Q9.(2024)

a)

elastic potential (energy)

b)

$$E_e = 0.5 \times 735 \times 8.0^2$$

$$E_e = 23\,520 \text{ (J)}$$

$$\text{total } E_e = 47\,040 \text{ (J)}$$

$$47\,040 = 240 \times 9.8 \times h$$

$$h = \frac{47\,040}{(240 \times 9.8)}$$

$$h = 20 \text{ (m)}$$

c)

air resistance (opposes the motion of the pod upwards)

(so) not all of the elastic potential energy will be transferred to gravitational potential energy