AQA GCSE 9-1 Physics Y10 Exam Name SA WORKED ANS
Practice Calculation Questions

Relationships to learn

P1	kinetic energy = 0.5 x mass x (speed)^2	$E_k = \frac{1}{2} m v^2$
P1	gravitational potential energy = mass x gravitational field strength (g) x height	$E_p = m g h$
P1	efficiency = useful output energy transfer / useful input energy transfer	
P1	% efficiency = 100 x useful output energy transfer / useful input energy transfer	
P1	power = energy transferred / time	$P = E / t$
P1	power = work done / time	$P = W / t$
P4	potential difference = current x resistance	$V = I R$
P5	power = potential difference x current	$P = V I$
P5	power = (current)^2 x resistance	$P = I^2 R$
P6	density = mass / volume	$\rho = m / V$

Relationships provided in exam

P1	elastic potential energy = 0.5 x spring constant x (extension)^2	$E_e = \frac{1}{2} k e^2$
P2 P6	change in thermal energy = mass x specific heat capacity x temperature change	$\Delta E = m c \Delta\theta$
P6	For gases: pressure x volume = constant	pV = constant

The Earth's gravitational field strength is 9.8 N/kg

1 A 1.2 kg ball is kicked at a speed of 4 m/s. Calculate its kinetic energy.

$E_k = \frac{1}{2}mv^2 = \frac{1}{2} \times 1.2 \times 4^2 =$

9.6 J

2 The 1.2 kg ball falls down a 3 m deep well.
Calculate how much gravitational potential energy is loses as it falls.

$E_p = mgh = 1.2 \times 9.8 \times 3 =$

35.3 J

3a Calculate the efficiency of a kettle that transfers 22 kJ of energy to the water in it for every 40 kJ of electrical energy supplied.

$Eff = {}^{USEFUL}/_{TOTAL} = \frac{22}{40} =$ 0.55

3b Give the efficiency of the kettle as a percentage.

$0.55 \times 100 =$ 55 %

4 Calculate the energy transferred by a 24 W lamp in 45 s.

$P = E/t \quad \therefore \quad E = Pt$

$= 24 \times 45 =$ 1080 J

5 Calculate the power of a motor that can do 3000 J of work in 12 s

$P = W/t = 3000/12 =$ 250 W

6 A lamp of resistance 25 ohms has a current of 3.2 A flowing through it.
Calculate the potential difference across the lamp.

$V = IR = 3.2 \times 25 =$ 80 V

7 A loudspeaker has a current of 1.2 A flowing through it and a potential difference of 18 V.
Calculate the power of the speaker.

$P = VI = 18 \times 1.2 =$ 21.6 W

8 A lamp of resistance 12 ohms has a current of 2 A flowing through it.
Calculate the power of the lamp.

$P = I^2R = 2^2 \times 12 =$ 48 W

9 Calculate the density of a block of metal of mass 25 kg and volume 0.02 m^3.

$\rho = m/V = 25/0.02 =$ 1250 kg/m^3

10 A spring of spring constant 25 N/m is extended by 0.2m
Calculate the energy it stores.

$E = \frac{1}{2}ke^2 = \frac{1}{2} \times 25 \times 0.2^2 =$ 0.5 J

11 Water has a specific heat capacity of 4.2 J/(°C g)
Calculate the energy needed to heat up a 250 g of water by 35 °C

$E = mc\Delta\theta = 250 \times 4.2 \times 35 =$ 36750 J

12 Calculate the pV gas constant for a sample of gas of pressure 2500 Pa and volume 15m^3

$pV = 2500 \times 15 =$ 37500 Nm

Section B Questions may require converting units and/or rearranging an equation.

13 A ball travelling at a velocity of 8 m/s has 250J of kinetic energy.
Calculate the mass of the ball.

$E_K = \frac{1}{2}mv^2 \quad \therefore \quad m = \frac{2E_K}{v^2} = \frac{2 \times 250}{8^2} =$ 7.81 kg

14 A lamp has a current of 1.25 A when the potential difference across it is 6 V
Calculate the resistance of the lamp.

$V = IR \quad \therefore \quad R = V/I = 6/1.25 =$ 4.8 Ω

15 A 350g block of metal required 1200 J of heat energy to warm it up from 12 °C to 25°C.
Calculate the specific heat capacity of the metal.

$E = mc\Delta\theta \quad \therefore \quad c = E/m\Delta\theta$

$c = 1200/350 \times (25-12) =$ 0.264 J/(°C g)

16 Calculate the energy stored in a spring of spring constant 120 N/m that has been compressed by 5cm. 5cm = 0.05m

$E = \frac{1}{2}ke^2 = \frac{1}{2} \times 120 \times 0.05^2$

0.15 J

17 A motor has an efficiency of 40%. How much electrical energy needs to be supplied for the motor to do 240 J of work.

$0.4 \times E = 240$

$\therefore \quad E = 240/0.4 =$ 600 J

18 Calculate the volume of 2kg of a liquid of density 2.2 kg/m^3

$\rho = m/V \quad \therefore \quad V = m/\rho = 2/2.2 =$

0.909 m^3

19 How much must a spring of spring constant 30 N/m be compresses to store 0.0375 J of energy.

$E = \frac{1}{2}ke^2 \quad \therefore \quad e = \sqrt{\frac{2E}{k}} = \sqrt{\frac{2 \times 0.0375}{30}} =$ 0.05 m

20 Calculate the velocity of a 1.2kg ball with a kinetic energy of 200J.

$E_K = \frac{1}{2}mv^2 \quad \therefore \quad v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2 \times 200}{1.2}} =$ 18.26 m/s

Section C Questions may involve more than one step, converting units and/or rearranging an equation.

21 A spring is stretches 20cm when a force of 2.5 N is applied.
Calculate the energy the spring will store when extended by 15cm.

20cm = 0·2m
15cm = 0·15m

$k = F/e = 2.5/0.2 = 12.5$ Nm

$E = \frac{1}{2}ke^2 = \frac{1}{2} \times 12.5 \times 0.15^2 =$

0·141 J

22 A weather balloon is filled with 120 m^3 of hydrogen at 100 kPa.
Calculate the volume of the balloon at an altitude of 40 km where the pressure is 0.90 kPa

$pV = 100 \times 120 = 12000$

$\therefore 0.90 \times V = 12000$

$\therefore V = 12000/0.90 =$ 13333 m^3

23 A 2500W kettle is filled with 1250g of 20 °C water of specific heat capacity 4.2 J/(°C g)
Calculate how long it will take to boil assuming it is 80% efficient.

20°C → 100°C = 80°C to boil

$E = mc\Delta\theta = 1250 \times 4.2 \times 80 = 420000$ J

$E_T = 420000/0.8 = 525000$ J

$t = E/p = 525000/2500 =$ 210 s

24 Calculate the speed that a 2000 W, 60% efficient motor, can lift a mass of 8.5 kg

In one second $E = 2000 \times 1 \times 0.6 = 1200$ J

$E_p = mgh \therefore h = E_p/mg = 1200/8.5 \times 9.8 =$

14·4 m/s

25 Calculate how long it would take a 120 kJ battery to be charged by a current of 1.2 A at a potential difference of 6.2 V

120 kJ = 120000 J

$P = VI = 6.2 \times 1.2 = 7.44$ W

$t = E/p = 120{,}000/7.44$

$= 16129$ s

$= 16129/3600 =$

4.48 hrs