*Assume gravitational field strength, g, is 9.8 N/kg when needed in any calculation in this paper.*

**1** **a)** Energy may be stored as chemical energy. Name two other forms of energy storage. (2)

 **b)** What form of energy is stored in wood that is to be used to make a bonfire? (1)

 **c)** What are the units in which energy is measured? (1)

**2** Ahmed has a mass of 60 kg and is driving a car travelling at 20 m/s. The car has a mass of 1340 kg.

 **a)** Calculate the total kinetic energy of the car plus Ahmed. Give your answer in kJ. Show your working. (2)

 **b)** Ahmed increases the car’s speed to 30 m/s.

 Calculate the increase in the kinetic energy of the car alone. Give your answer in kJ. (2)

 **c)** Ahmed turns off the engine and allows the car to coast to a stop as it travels up a hill. He then puts the handbrake on. What form of energy has the kinetic energy of the car been converted into? (1)

 **d)** How much kinetic energy has Ahmed when he is sitting in the car at this point. Give a reason for your answer. (2)

**3** A cricket ball has a mass of 160 g. Andi throws the ball vertically upwards at a speed of 12 m/s. As the effect of gravity slows the ball it stops, momentarily, at point, P, and then falls back to the ground. Assuming that none of the ball’s energy is transferred to its surroundings:

 

 **a)** Calculate the maximum kinetic energy of the ball. (2)

 **b)** What is maximum increase in gravitational potential energy acquired by the ball? (1)

 **c)** What is the maximum height reached by the cricket ball? (2)

 **d)** If the ball had a gravitational potential energy of 18 J at point P, what would its initial speed have been? (3)

**4** The following paragraph is about energy transfer. Complete the sentences using the correct words from the list given below.

temperature  battery  created  circuit  light  destroyed   chemical  absorbed

 Light, sound and electricity are not stores of energy. They are ways of transferring energy from one store to another. Electrical energy cannot be bought in boxes, unlike cells or batteries. The ………………… energy stored in a cell or battery causes an electric charge to flow through a …………………….. The chemical energy stored in a torch ………………… causes an electric current. This is a flow of charge. The electric current will make the …………………….. of the bulb increase. The rise in temperature causes the bulb to …………… . This light energy cannot be stored. When the light strikes an object, it is ………………………. and the internal energy of the object increases. In any process, energy can be transferred from one store to another, but energy cannot be ……………………. or ……………………… . (8)

**5** Fill in the blanks in the sentences below.

 **a)** One joule of work is done when a ………… of 1 ……… causes a displacement of …….. centimetres. (1)

 **b)** Power is defined as the rate at which ……… is transferred or the rate at which
……….. is done. (1)

 **c)** A ……… is the unit of power. (1)

**6** A crane lifts a shipping container to a height of 16 metres in 30 seconds.

 **a)** If the container has a mass of 15 000 kg, what power is being applied by the crane? (2)

 **b)** Calculate the increase in gravitational potential energy of the shipping container in MJ. (2)

**7** Three hunting dogs are being tested to see which is the most powerful. They are each made to run to the top of a hill. The hill is 50 metres high. The table records the data that is collected.

|  |  |  |
| --- | --- | --- |
| Dog | Weight (N) | Time (s) |
| A male | 320 | 24 |
|  B female | 280 | 20 |
| C male | 360 | 26 |

 **a)** Does a male or a female dog expend the most power getting to the top of the hill? Show your working. (4)

 **b)** Which of the male dogs expends the most power getting to the top. (1)

 **c)** What is the **total** power expended by **all** the dogs in getting to the top of the hill? (2)

 **d)** Explain which dog increases its gravitational potential energy the most. (2)

**8** A bed spring has a spring constant of 200 N/m. When Eric lies on the bed, he compresses that spring by 3 cm.

 **a)** What is the elastic potential energy stored in that spring when it is compressed by Eric? Express your answer in mJ (2)

 **b)** Calculate the elastic potential energy if the spring constant of a different bed was 400 N/m and Eric compresses the spring by 1.5 cm. Express your answer in mJ (2)

TOTAL = 47

**1 a)** Two from kinetic, thermal, magnetic, gravitational potential, nuclear, electrostatic, electrostatic potential. (2)

 **b)** Chemical (1)

 **c)** Joules (1)

**2 a)**  = 280 kJ (2)

 **b)**  = 335 kJ (2)

 **c)** Gravitational potential energy. (1)

 **d)** None. All the kinetic energy has been converted to gravitational potential energy. Ahmed is not moving. (2)

**3 a)**  = 11.52 J (2)

 **b)** 11.52 J (1)

 **c)** *h* =  =  = 7.35 m or *mgh* = 11.52; *h* = 7.35 m (2)

 **d)** ; *v* = 15 m/s (3)

**4** Light, sound and electricity are not stores of energy. They are ways of transferring energy from one store to another. Electrical energy cannot be bought in boxes unlike cells or batteries. The **chemical** energy stored in a cell or battery causes an electric charge to flow through a **circuit**. The chemical energy stored in a torch **battery** causes an electric current. This is a flow of charge. The electric current will make the **temperature** of the bulb increase. The rise in temperature causes the bulb to **light** up. The light energy cannot be stored. When the light strikes an object, it is **absorbed** and the internal energy of the object increases. In any process energy can be transferred from one store to another, but energy cannot be **created** or **destroyed**. (8)

**5 a)** One joule of work is done when a **force** of 1 **newton** causes a displacement of **100** centimetres. (1)

 **b)** Power is defined as the rate at which **energy** is transferred or the rate at which **work** is done.  (1)

 **c)** A **watt (W)** is the unit of power. (1)

**6 a)** =  = 78 400 W (2)

 **b)** *mgh* =  = 2.35 MJ (2)

**7 a)** A male power =  = 666.67 W

 B female power = 700.00 W

 C male power = 692.31 W

 Answer = female (4)

 **b)** C (1)

 **c)** 666.67 + 700.00 + 692.31 = 2058.98 W (2)

 **d)** increase in gravitational potential energy = (*mgh*) or weight × height increase. All dogs  climb 50 m. Therefore the heaviest dog increases gravitational potential energy the
most, i.e. dog C. (2)

**8** Elastic potential energy = × spring constant × extension2

 **a)**  × 200 × = 0.09 J = 90 mJ (2)

 **b)**  × 400 × = 0.045 J = 45 mJ (2)

TOTAL = 47