1. (a) State what is meant by *the principle of conservation of energy*.

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(b) Fig. 2.1 shows a girl throwing a heavy ball.



Fig 2.1

**(i)** State the energy changes that take place from when the girl begins to exert a force on

the ball until the ball hits the ground and stops moving.

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**(ii)** The mass of the ball is 6.0 kg. The girl exerts a force on the ball for 0.80 s. The speed of

the ball increases from 0 m / s to 14 m / s before it leaves the girl’s hand.

Calculate:

1. the momentum of the ball on leaving the girl’s hand

Momentum = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. the average resultant force exerted on the ball.

Average force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. An electric pump is used to raise water from a well, as shown in Fig. 3.1.



**(a)** The pump does work in raising the water. State an equation that could be used to

calculate the work done in raising the water.

......................................................................................................................................[2]

**(b)** The water is raised through a vertical distance of 8.0 m. The weight of water raised in

5.0 s is 100 N.

**(i)** Calculate the work done in raising the water in this time.

work done = .......................[1]

**(ii)** Calculate the power the pump uses to raise the water.

power = ........................[1]

**(iii)** The energy transferred by the pump to the water is greater than your answer to **(i)**.

Suggest what the additional energy is used for.

..............................................................................................................................[1]

3. Fig. 2.1 shows a steam safety valve. When the pressure gets too high, the steam lifts the

weight W and allows steam to escape.



**(a)** Explain, in terms of moments of forces, how the valve works.

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**(b)** The moment of weight W about the pivot is 12 N m. The perpendicular distance of the

line of action of the force of the steam on the valve from the pivot is 0.2 m.

The area of the piston is 0.0003 m2.

Calculate

**(i)** the minimum steam force needed for the steam to escape,

force = ................................................

**(ii)** the minimum steam pressure for the steam to escape.

pressure = ................................................