Barrhead High School

NATIONAL PHYSICS

Energy & Gas Laws
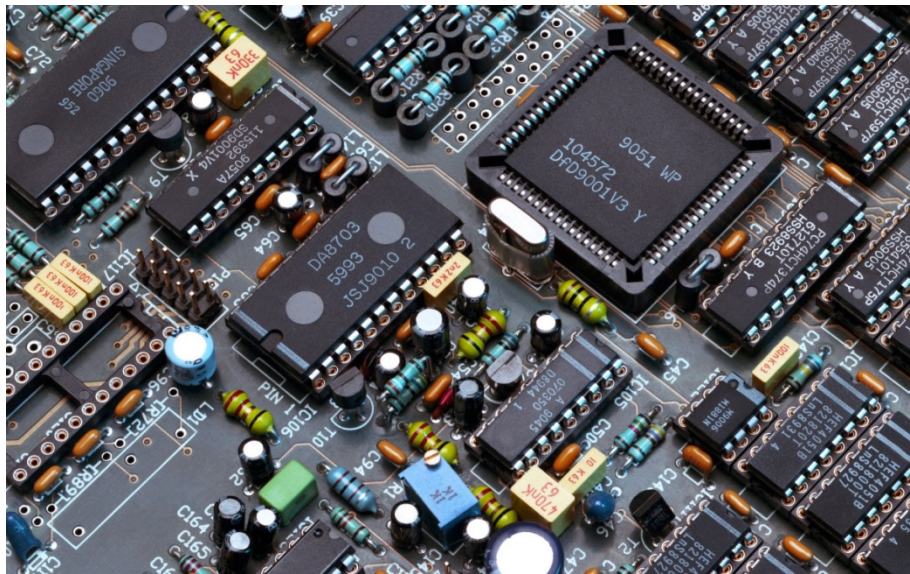
Exam Homework

Date	Homework	Mark/grade	Parent signature

The table above must be completed after each homework has been marked.

Homework tips

- Start homework as soon as possible. Do not leave it until the night before the due date.
- Refer to summary notes, jotter notes and example problems when completing homework.
- If after doing above there are any issues ask your teacher for help. This must be done at least 1 full day before due date. This will then give you the opportunity to complete the homework by due date.
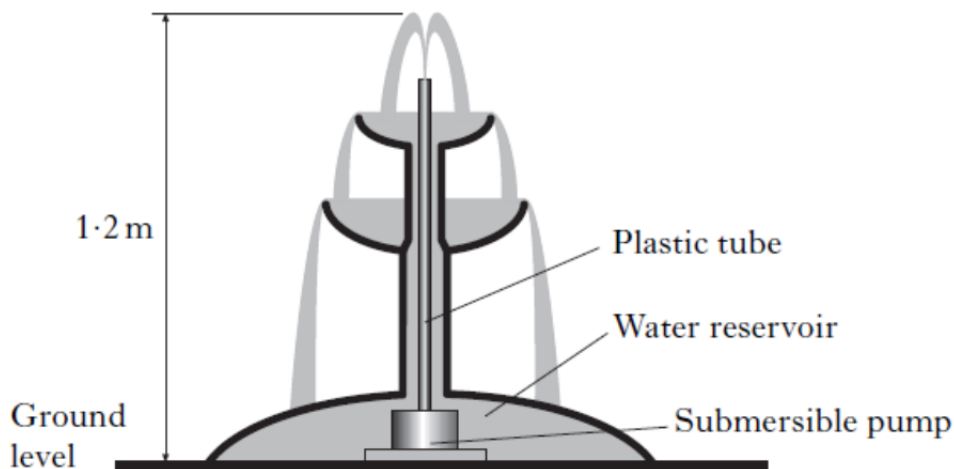
Sign below to state that you have read this.

Pupil _____

Parent _____

Homework 1

1   A small submersible pump is used in a garden water fountain. The pump raises 25 kg of   water each minute from a reservoir at ground level.
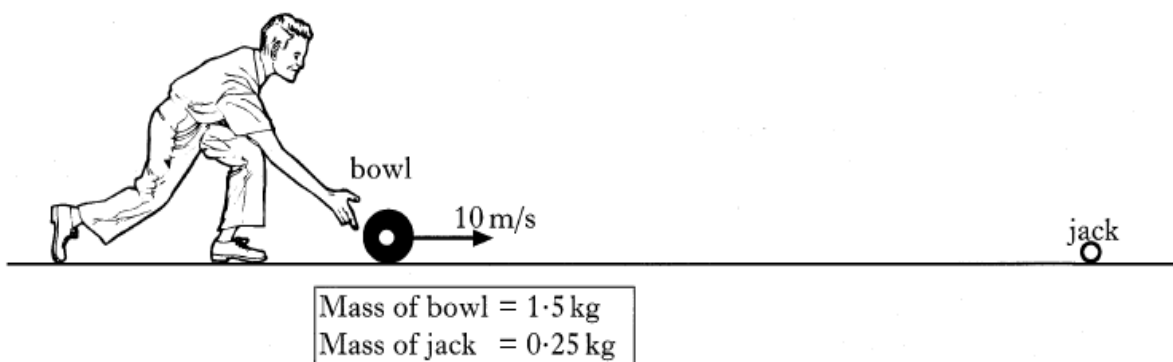

The water travels through a plastic tube and reaches a height of 1.2m above ground level.

Calculate how much gravitational potential energy the water gains each minute.

Space for working and answer

3

2   In a game of bowls, a bowler releases a bowl with a velocity of 10 ms^{-1}.

bowl
10 m/s
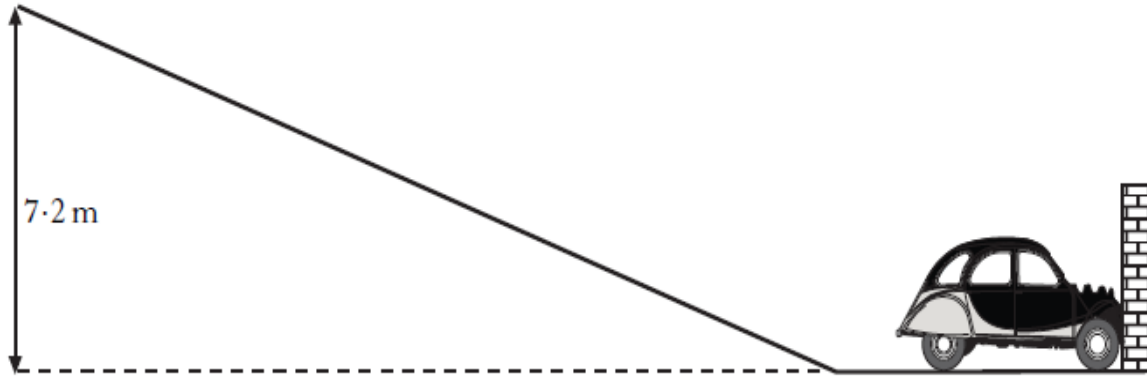jack

Mass of bowl = 1·5 kg
Mass of jack = 0·25 kg

Show that the kinetic energy of the bowl when it is released is 75J.

Space for working and answer

3

3   An early method of crash testing involved a car rolling down a slope and colliding with a wall. In one test, a car of mass 750 kg starts at the top of a 7.2m high slope.

7·2 m

a   Calculate the gravitational potential energy of the car at the top of the slope.

Space for working and answer

3

b i   State the value of the kinetic energy of the car at the bottom of the slope, assuming there are no energy losses

Space for working and answer

1

ii   Calculate the speed of the car at the bottom of the slope, before hitting the wall
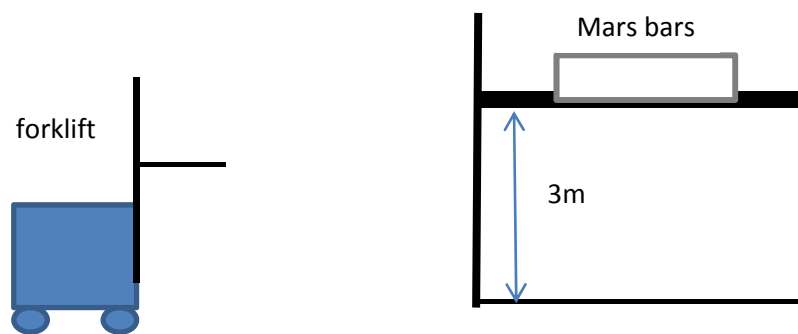
Space for working and answer

3

End of homework

Total 13

Homework 2

1   A forklift driver raises a pallet of Mars bars on to a shelf of height 3m.
       The total mass of the Mars bars is 5kg.

a)   Calculate the gain in gravitational potential energy of the Mars bars.   **3**

Space for working and answer

b)   The forklift carries out the lift in a time of 30s.   **3**
      Calculate the power developed by the forklift.

Space for working and answer

c)   The actual power developed by the forklift is not equal to the answer in part (b).
      Will it be more or less?   **2**
      Justify your answer.

Space for working and answer

(8)

2   A photographer has laser eye surgery. The laser used in the procedure produces 250 pulses of light per second. Each light pulse transfers 60 mJ of energy.

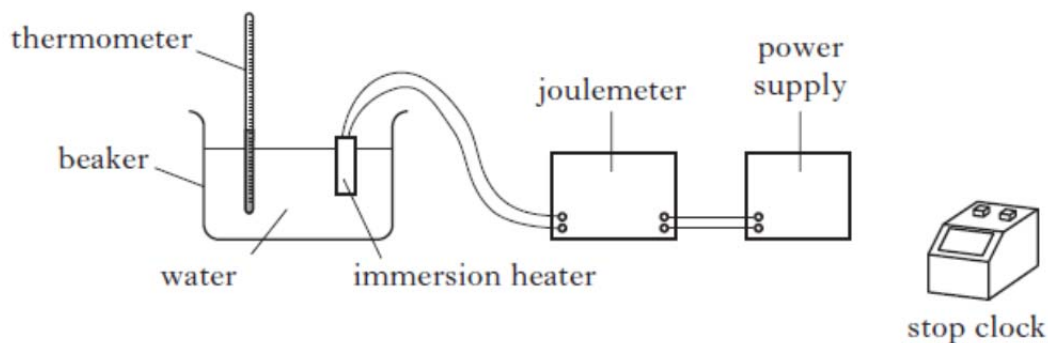Calculate the average power produced by each pulse of light.   **4**

Space for working and answer

End of Homework

Total   12

Homework 3

1   An experiment was carried out to determine the specific heat capacity of water.
     The energy supplied to the water was measured by a joulemeter.

The following data was recorded.
          Initial temperature of the water = 21 °C.
          Final temperature of the water   = 33 °C.
          Initial reading on the joulemeter = 12 kJ.
          Final reading on the joulemeter = 120 kJ.
          Mass of water   = 2.0 kg.
          Time   = 5 minutes.

a)   Calculate the value for the specific heat capacity of water obtained
     from this experiment.   **4**

Space for working and answer

b   i)   The accepted value for the specific heat capacity of water is quoted in the table
          in the Data Sheet.   **2**
          Explain the difference between the accepted value and the value obtained in the
          experiment.

Space for working and answer

Continued overleaf

ii) State one improvement that can be made to the experiment that would reduce this difference.   **1**

> Space for working and answer

2   When the shuttle spacecraft re-enters Earth's atmosphere, the velocity of the shuttle decreases from 7000 m/s to 1000 m/s in a short time. This causes the insulation on the lower surface of the shuttle to reach temperatures of approximately 1500°C.

a)   What is the main reason for this rise in temperature?   **1**

> Space for working and answer

b) i)   The total mass of the space shuttle is 2.7×10^6 kg.   **5**
     Calculate the loss in kinetic energy of the shuttle during this time.

> Space for working and answer

ii) Calculate the rise in temperature of the insulation during this deceleration. **3**
The specific heat capacity of the insulation is 10 X 10 ^{6} J/kg°C.
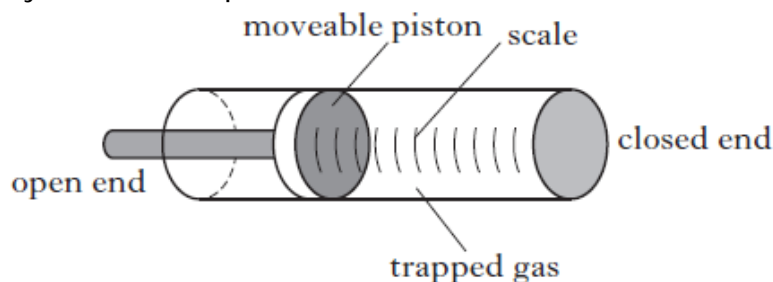The mass of the insulation is 4400kg

Space for working and answer

Total **16**

End of Homework

Homework 4

1   A diver is measuring the pressure at different depths in the sea using a simple pressure gauge. Part of the pressure gauge consists of a cylinder containing gas trapped by a moveable piston.

At sea level, the atmospheric pressure is 1·01 x 10^5 Pa and the trapped gas exerts a force of 262 N on the piston.

a)   Calculate area of the piston

3

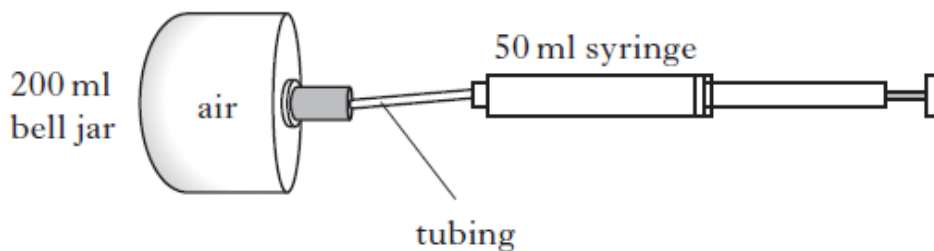| Space for working and answer |
|---|
| |

b)   The diver now descends to a depth, h, where the gauge registers a total pressure of 5·13 × 10^5 Pa. The temperature of the trapped gas remains constant.
While at this depth, a bubble of gas is released from the diver's breathing apparatus.
State what happens to the volume of this bubble as it rises to the surface.
Justify your answer.

2

Space for working and answer

Continued overleaf

2   A technician uses the equipment shown to investigate the relationship between the volume and pressure of a gas at constant temperature.

The pressure in the bell jar is 1.01×10^5 Pa.

a)   The technician uses a syringe to remove 50 ml of the air from the bell jar. Calculate the new pressure of the air inside the bell jar.

3

Space for working and answer

b)   Use the kinetic model to explain this change in pressure after removing air with the syringe.
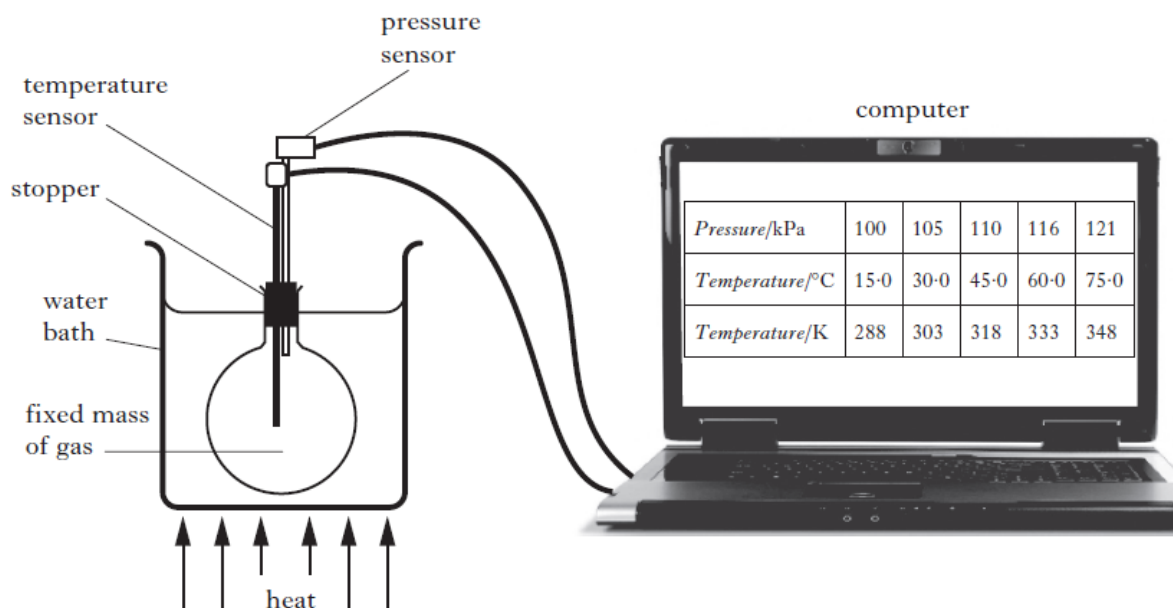
4

Space for working and answer

Total   12

End of Homework

Homework 5

1   A student carries out an experiment to investigate the relationship between the pressure and temperature of a fixed mass of gas. The apparatus used is shown.

The pressure and temperature of the gas are recorded using sensors connected to a computer. The gas is heated slowly in the water bath and a series of readings is taken.
The volume of the gas remains constant during the experiment.
The results are shown.

Pressure/kPa	100	105	110	116	121
Temperature/°C	15·0	30·0	45·0	60·0	75·0
Temperature/K	288	303	318	333	348

a)   Using all the relevant data, establish the relationship between the pressure and the temperature of the gas.

3

Space for working and answer

b) Use the kinetic model to explain the change in pressure as the temperature of the gas increases.

3

Space for working and answer

c) Explain why the level of water in the water bath should be above the bottom of the stopper.

1

Space for working and answer

2   In the experiment below, the plunger moves up as the container is heated. This keeps the pressure inside the container constant.

Charles's Law

Volume (V1)   Volume (V2)

Temperature (T1)   Temperature (T2)
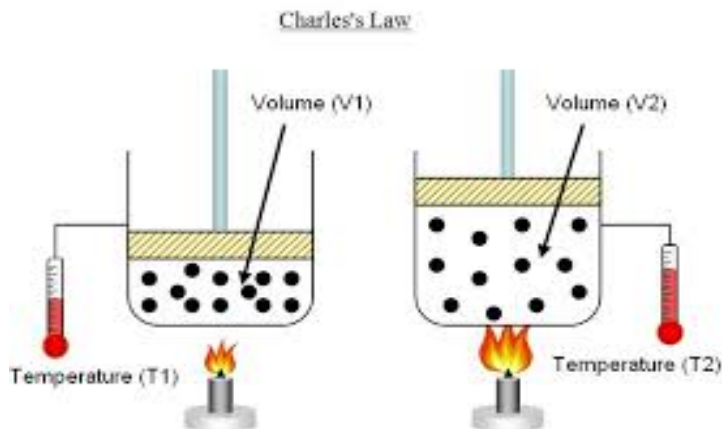
Using the kinetic theory of gases, explain why the plunger needs to rise to keep pressure constant.

3

Space for working and answer

Total   10

End of Homework