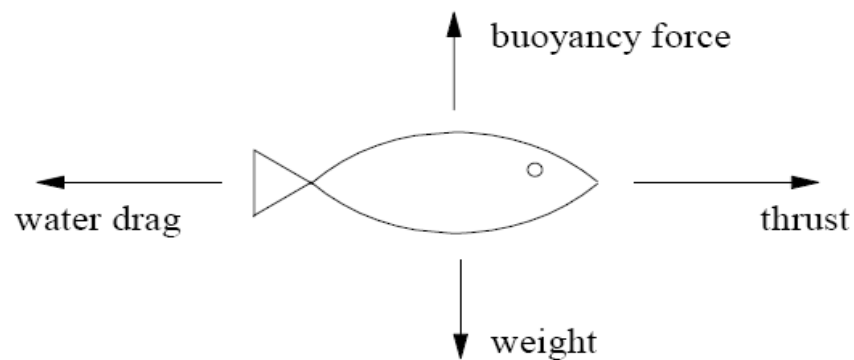


## 2IB Phys. Training April 2008, HL + SL

Show working including argumentation!

### M00 SL P1, 3

The figure below shows the forces on a fish as it swims with a constant velocity.



The resultant (net) force acting on the fish is

- A. zero.
- B. upwards.
- C. downwards.
- D. forwards.

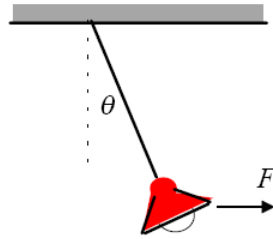
### M00 SL P1, 4

A stone falls towards the Earth. The force that the stone exerts on the Earth is

- A. zero.
- B. less than the force the Earth exerts on the stone.
- C. greater than the force the Earth exerts on the stone.
- D. equal to the force the Earth exerts on the stone.

**M00 SL P1, 5**

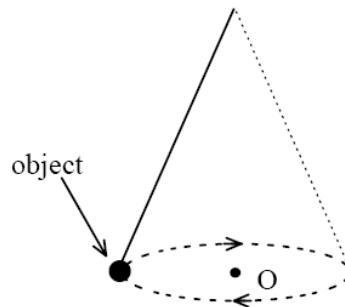
A steady horizontal stream of air blows a lamp suspended by a light wire so that the wire is at an angle  $\theta$  to the vertical as shown. If the tension in the wire is  $T$ , the horizontal force on the lamp,  $F$ , is given by



- A.  $\frac{T}{\cos \theta}$ .
- B.  $T \sin \theta$ .
- C.  $T \cos \theta$ .
- D.  $\frac{T}{\sin \theta}$ .

**M00 SL P1, 6**

A small object, suspended by a string, rotates with constant speed, in a horizontal circle as shown in the figure. Point O is at the centre of the circle.



Which one of the following statements is correct?

- A. The object is in equilibrium
- B. There is a resultant force on the object directed away from O
- C. A force acts on the object in the direction of its motion
- D. There is a resultant force on the object directed towards O

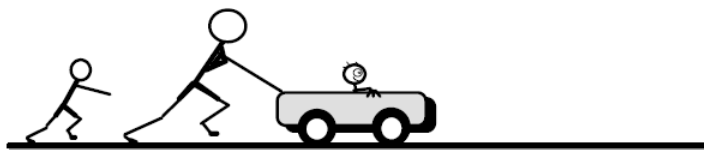
**M00 SL P1, 7**

Two vehicles, A and B, are moving directly towards each other. Vehicle A has a mass of 1000 kg and speed  $5.0 \text{ ms}^{-1}$ . Vehicle B has a mass of 500 kg and speed of  $20.0 \text{ ms}^{-1}$ . The magnitude of the total momentum of the two vehicles is

- A. zero.
- B.  $5000 \text{ kg ms}^{-1}$ .
- C.  $10\,000 \text{ kg ms}^{-1}$ .
- D.  $15\,000 \text{ kg ms}^{-1}$ .

**M00 SL P1, 8**

Marcella gives her baby sister a ride in a cart. She pushes the cart steadily along the length of a horizontal driveway. Starting from rest, at the end of 4 m the cart ends up with a speed of  $2 \text{ ms}^{-1}$ . Later Marcella's younger brother pushes the cart but with only half as much force. Over what distance would he need to push his baby sister, to give her a speed of  $2 \text{ ms}^{-1}$ ? (Assume the cart wheels spin frictionlessly.)



- A. 4 m
- B. 8 m
- C. 16 m
- D. Further than 16 m

**M00 SL P1, 10**

The temperature of an ideal gas is a measure of the gas molecules'

- A. average velocity.
- B. maximum velocity.
- C. average kinetic energy.
- D. total kinetic energy.

**M00 SL P1, 9**

A particle is undergoing simple harmonic motion. When it is at its maximum displacement from its equilibrium position, which one of the following about its velocity and acceleration is correct?

	<b>Velocity</b>	<b>Acceleration</b>
A.	zero	maximum
B.	zero	zero
C.	maximum	zero
D.	maximum	maximum

**M00 SL P2, A3**

This question is about the phase (state) changes of the element lead.

A sample of lead has a mass of 0.50 kg and a temperature of 27 °C. Energy is supplied to the lead at the rate of 1.5 kW. After 0.2 minutes of heating it reaches its melting point temperature of 327 °C. After heating for a further 3 minutes all the lead has become liquid.

- (a) Assuming that all the energy goes into heating the lead, calculate a value for the
- (i) specific heat capacity of lead.
  - (ii) latent heat of fusion of lead.
- (b) Energy continues to be supplied to the lead. On the axes below sketch a graph to show how the temperature of the lead varies with time from the start of heating to some 5 minutes after the time when all the lead has become liquid. Indicate on the graph the time at which it starts to melt and the time when it has become liquid.

*(You are not expected to have accurate scales, this is just a **sketch** graph.)*

- No graph presented below, created one yourself

## 2IB Phys. Training April 2008, HL only

Show working including argumentation!

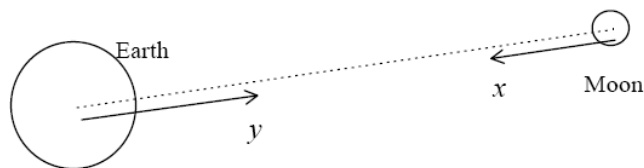
### M00 HL P1, 8

A satellite is orbiting the earth in a circular orbit. Which one of the following properties of the satellite does **not** remain constant?

- A. Kinetic energy
- B. Gravitational potential energy
- C. Angular momentum
- D. Velocity

### M00 HL P1, 9

The Earth has approximately 81 times the mass of the Moon. There is a point between the Earth and the Moon where their resultant gravitational field is zero. If the distance to this point from the centre of the Earth is  $y$  and from the centre of the Moon it is  $x$ , the ratio of  $y/x$  is approximately



- A.  $(81)^{1/4}$
- B.  $(81)^{1/2}$
- C. 81
- D.  $81^2$

**M00 HL P1, 16**

When the volume of a gas increases, it does work. The work done would be greatest for which one of the following processes?

- A. Isobaric.
- B. Adiabatic.
- C. Isothermal.
- D. The work done would be the same for all of the above.

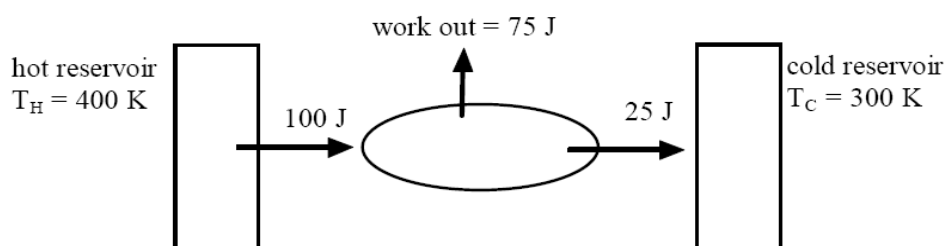
**M00 HL P1, 17**

A system absorbs 70 J of thermal energy and in the process does 40 J of work. The internal energy change is

- A. 30 J.
- B. 40 J.
- C. 70 J.
- D. 110 J.

**M00 HL P1, 18**

It is proposed to build a heat engine that would operate between a hot reservoir at a temperature of 400 K and a cold reservoir at 300 K. See the diagram below. In each cycle it would take 100 J from the hot reservoir, lose 25 J to the cold reservoir and do 75 J of work.



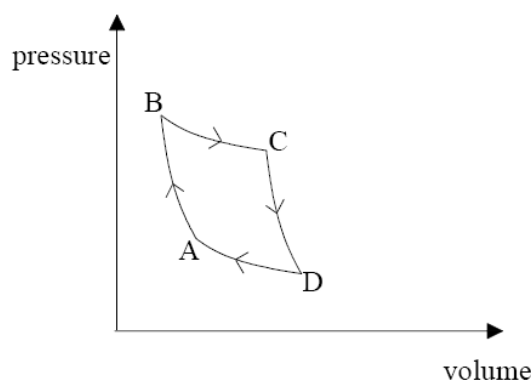
This proposed heat engine would violate

- A. both the first and the second laws of thermodynamics.
- B. the first but not the second law of thermodynamics.
- C. the second but not the first law of thermodynamics.
- D. neither the first nor the second law of thermodynamics.

## M00 HL P2, B1 part 2

### Part 2. The Carnot Cycle and Entropy

The diagram below shows the pressure–volume relationship for a fixed mass of an ideal gas that undergoes a Carnot cycle.



The process from  $B \rightarrow C$  takes place at a constant temperature of 1000 K and the process from  $D \rightarrow A$  takes place at a constant temperature of 500 K.

- (a) During which of the four processes is work done
- (i) **by** the gas? [2]
  - (ii) **on** the gas? [2]
- (b) How can the total work done during a cycle be determined from the graph? [1]
- (c) Calculate the efficiency of the cycle. [1]
- (d) The Second law of Thermodynamics can be stated as “*all irreversible processes increase the entropy of the Universe*”.

Explain from a molecular point of view how the following changes lead to an entropy increase of the Universe:

- (i) a bouncing ball that comes to rest.
- (ii) the collapse of a toy balloon when it is pricked by a pin. [2]