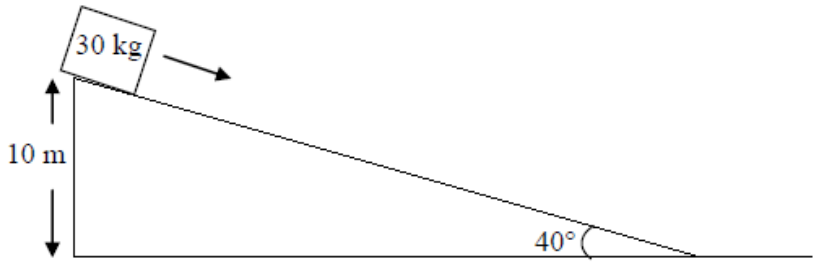
BA SANGAM COLLEGE
YEAR 12
PHYSICS
WORKSHEET 1

2009

A 30 kg box slides down a frictionless slope as shown below. The box starts from rest and slides down a vertical distance of 10 m.



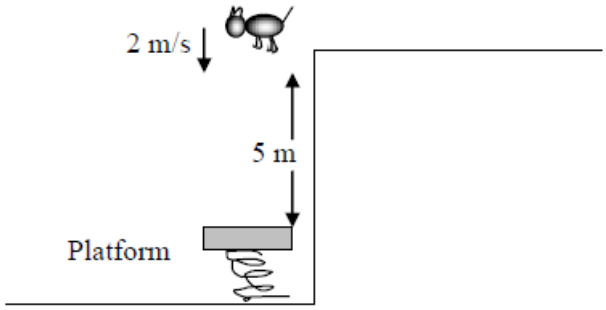

7. The work done by the box upon reaching the bottom of the slope would be

A. 230 J
B. 300 J
C. 1 500 J
D. 3 000 J

8. The speed of the box upon reaching the bottom of the slope would be

A. 3.92 m/s
B. 4.47 m/s
C. 10.00 m/s
D. 14.14 m/s

(b) A cat of mass 4 kg jumps off a cliff with an initial vertical velocity of 2 m/s onto a platform situated 5 m below the cliff as shown below.




After touching the platform, the cat is bounced into the air to a vertical height of 4 m.

(i) Calculate the kinetic energy of the cat as it hits the platform. **(2 marks)**

(ii) The spring attached to the platform is compressed as the cat hits the platform. Determine the compression of the spring if its spring constant is 200 N/m. **(2 marks)**

(iii) How much energy is lost as the cat bounces off the platform ? **(2 marks)**

(b) A 500 g mass falls from a height of 100 m. If all the energy lost by the mass can be totally harnessed, determine the mass, in kg, of ice at 0 °C that can be melted by this energy. (Latent heat of fusion of $H_2O$ is 335 000 J/kg.) **(2 marks)**

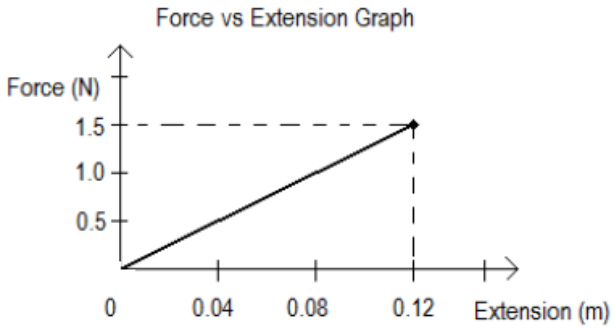
(d) A small metal block of mass 74 g is heated in an oven to 90° C. It is then taken from the oven and immediately put in a calorimeter, which is insulated to prevent heat losses. The calorimeter contains 300 g of water at 10° C. The heat capacity of the calorimeter is negligible and the final temperature is 14° C. Calculate the specific heat capacity of the metal block.
(Specific heat capacity of water is 4 200 J/°C/kg) **(3 marks)**

2010

12. What is the name given to the amount of energy needed to turn 1 kg of water at 100 °C into steam?

A. specific latent heat
B. specific heat capacity
C. latent heat of fusion
D. latent heat of vapourisation

(a) In an experiment on **Hooke's Law**, masses were attached to a light helical spring. The graph below shows the result of the experiment.




(i) Calculate the value of the spring constant. **(1 mark)**

(ii) How much energy is stored in the spring when it is extended by 0.12 m? **(1 mark)**

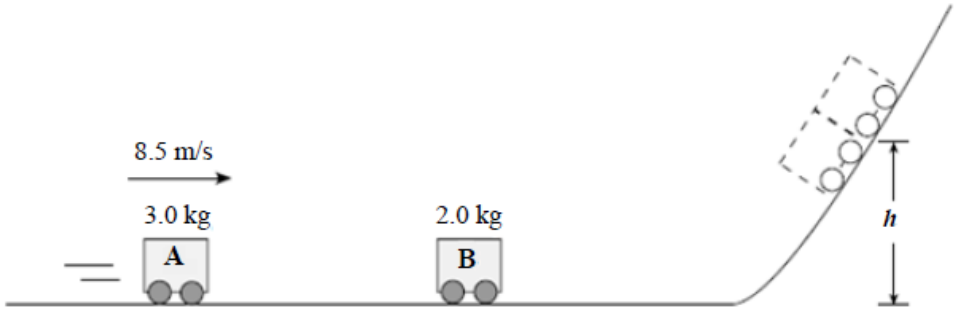
(a) A kettle has a power rating of 3 kW. If 1.5 kg of water at 5 °C is put into the kettle and heated to boil at 100 °C:

(i) How much energy is needed to boil the kettle? (Assuming no heat is lost.) **(1 mark)**

(ii) How long will the kettle take to boil? **(1 mark)**

[specific heat capacity for water is 4 200 J/kg °C]

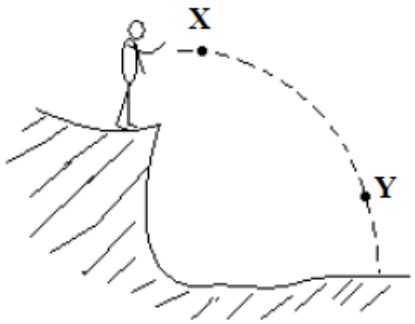
(c) A 3.0 kg car, **A** travelling at 8.5 m/s on a frictionless track collides and sticks on to a stationary 2.0 kg car **B**.




(i) Calculate the momentum of car **A** before the collision. **(1 mark)**

(ii) Calculate the combined velocity after the collision. **(1 mark)**

7. A person standing at the top of a cliff throws a stone as shown in the diagram below.



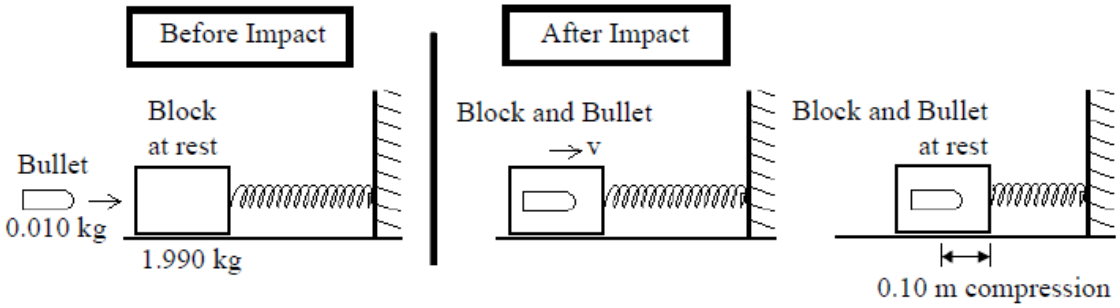

Which form of energy does the stone have at **X** and **Y**?

| | **Energy at X** | **Energy at Y** |
|---|---|---|
| A. | Gravitational only | Kinetic only |
| B. | Kinetic only | Gravitational only |
| C. | Gravitational only | Gravitational and Kinetic |
| D. | Gravitational and Kinetic | Gravitational and Kinetic |

9. Renewable energy cannot be exhausted and are non-polluting. Which of the following is **not** a renewable energy source?

A. Geothermal energy
B. Nuclear energy
C. Wind energy
D. Biomass

(c) In the diagram below, a bullet of mass 0.010 kg strikes and embeds itself in a block which has a spring attached to it. The mass of the block is 1.990 kg and is at rest on a frictionless horizontal surface. The spring has a spring constant of 200 N/m. After being hit by the bullet, the block compresses the spring by 0.10 m.

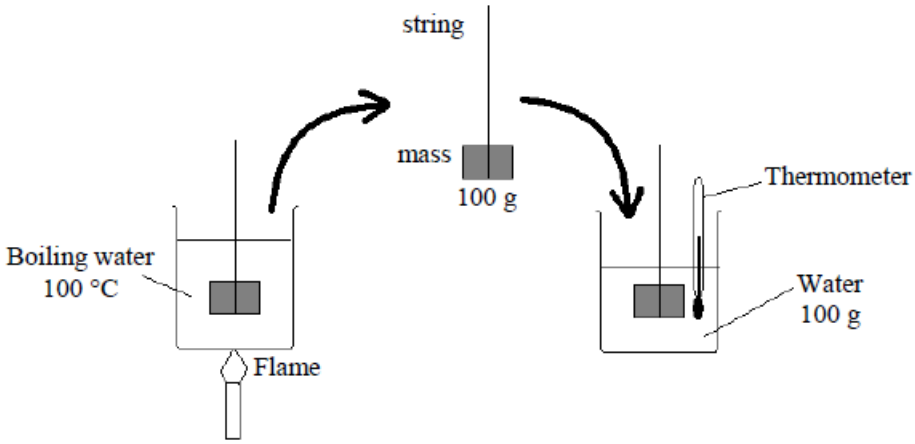



(i) Calculate the elastic potential energy stored in the spring by the block and bullet after impact. **(1 mark)**

(ii) Use the principle of conservation of energy to find the speed, v, of the block and bullet immediately after impact, before they compress the spring. **(2 marks)**

(iii) Find the speed of the bullet just before it hits the block. **(2 marks)**

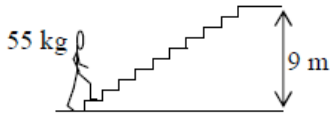
(c) In a Form 6 Physics experiment, a 100 g piece of metal is placed in boiling water at 100 °C for about 5 minutes. It is taken out and dropped into 100 g of water at 20 °C. The maximum final temperature of the mixture is 26.6 °C. The specific heat capacity of water is 4.2 J/g°C




Calculate the specific heat capacity of the metal. **(2 marks)**

2012

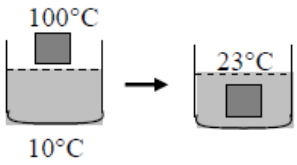
(a) A student of mass 55 kg has to climb a flight of stairs that has a vertical height of 9 m above the ground, everyday to get to class. On average, the student will take 36 s to do this task.




(i) What is the student's weight? **(½ mark)**

(ii) Calculate the average power needed by the student to climb these stairs. **(1½ marks)**

(b) A piece of aluminium of mass 0.400 kg at 100°C is lowered into 0.500 kg of water at 10°C. The resulting temperature of the mixture is 23°C. Assume that there are no heat losses. Specific heat capacity of water is 4 200 J $kg^{-1}$ $°C^{-1}$




Calculate the following:

(i) heat gained by the water **(1 mark)**

(ii) specific heat capacity of aluminium **(1 mark)**

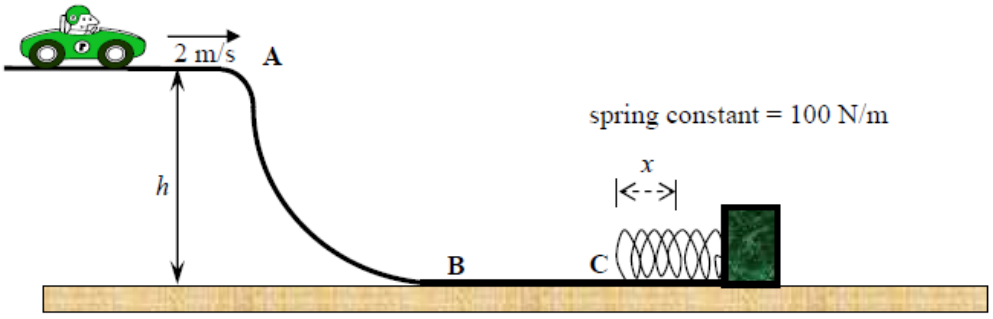
(a) Fill in the blanks with the **most** appropriate key word provided below.

| **heat, kinetic, potential, chemical, electrical, sound** |
|---|

In a wood chip steam generated power station, the _____(i)_____ energy of wood chips becomes _____(ii)_____ energy which changes water into steam. The steam drives a turbine which drives a generator. A generator transfers _____(iii)_____ energy into _____(iv)_____energy.

**(2 marks)**

(b) The diagram below shows a 0.5 kg toy car being released from point **A** where its velocity is 2 m/s. It moves down a frictionless track to **B** where its velocity is 10 m/s.



(i) Calculate the total energy at **B**. **(1 mark)**

(ii) Find the height, *h*, from which the toy car was released. **(1 mark)**

(iii) A spring with spring constant 100 N/m is used to slow the toy car and stop it some distance *x* from point C. Calculate this distance *x*. **(1 mark)**

(b) In a Form 5 physics experiment, the cooling curve of naphthalene was studied. This was done by heating solid naphthalene until it melted and then allowing it to cool. The table of results is shown below.

| **Time (min)** | 0 | 2 | 4 | 6 | 10 | 15 | 16 | 18 | 20 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature (°C)** | 90 | 86 | 82 | 80 | 80 | 80 | 80 | 79 | 78 | 77 | 76 |

(i) State the time period in which latent heat of fusion is being released. **(1 mark)**

(ii) Explain the energy changes undergone by the molecules of naphthalene during the period when latent heat of fusion is being released. **(1 mark)**

2013

4. Hooke's Law states that "the extension of a spring is directly proportional to the force applied." The **area** under the Force versus Extension graph gives the

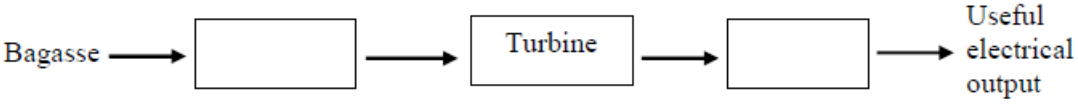
A. kinetic energy.
B. spring constant.
C. total distance travelled.
D. elastic potential energy.

7. The **Law of Conservation of Energy** states that,

A. for a body at rest, total mechanical energy is zero.
B. for a moving body, work done equals kinetic energy.
C. energy before a collision is the same as energy after a collision.
D. energy is neither created nor destroyed; it only changes its form.

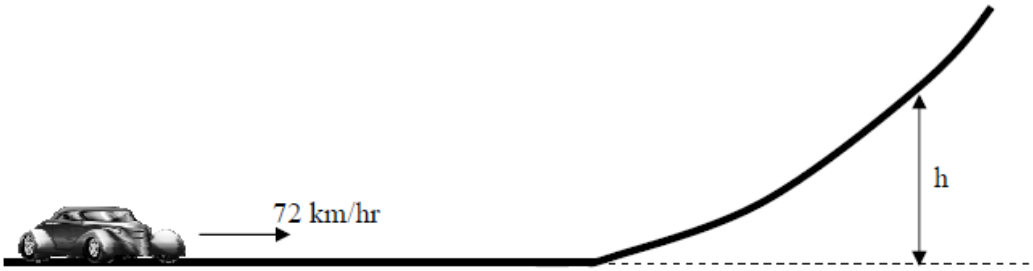
(b) (i) Give **one** example of a renewable and a non-renewable energy source. **(1 mark)**

(ii) The Fiji Sugar Corporation(FSC) generates electricity at its mill in Lautoka by burning 'bagasse', the waste residue of crushed sugar cane, which they then sell to the Fiji Electricity Authority. The flow chart below illustrates this process of electricity generation but it is incomplete. In your **Answer Book**, complete the flow chart.




**(1 mark)**

(a) A car, of unknown mass, is travelling along a level road at 72 km/hr when suddenly its brake fails. Luckily the road is clear of any traffic and the driver sees a hill in front. He decides to steer the car up the hill. Ignore friction for this problem.

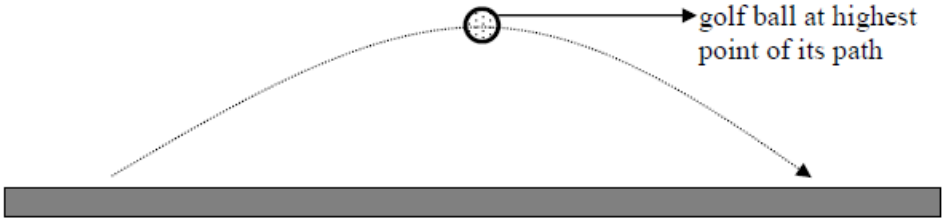



(i) Convert 72 km/hr to metres per second (m/s). **(1 mark)**

(ii) Use your answer in part (i) above to determine the maximum height, h, to which the car goes up the hill. **(1 mark)**

2014

6. The diagram below shows a golf ball hit along a level fairway at the highest point of its path.




At the position shown, the golf ball has

A. only kinetic energy.
B. only gravitational potential energy.
C. both kinetic and gravitational potential energy.
D. neither kinetic nor gravitational potential energy.

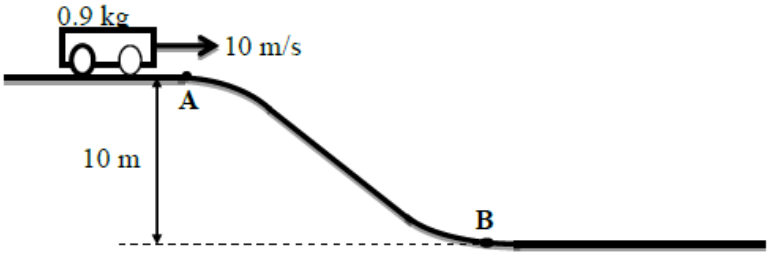
8. An example of a renewable energy source is

A. coal.
B. sunlight.
C. petroleum.
D. nuclear power.

(d) A saucepan of mass 0.7 kg containing 0.5 kg of water at 20 °C is heated. It takes 5 minutes before the water starts to boil. Given that the specific heat capacity of water is 4 200 J/kg°C and the specific heat capacity of the saucepan material is 600 J/kg°C, calculate the heat energy absorbed by both the water and the saucepan. **(2 marks)**

2015

(b) A trolley of mass 0.9 kg moves at 10 m/s until it comes to a downward slope.




(i) Calculate the potential energy of the trolley at point A. **(1 mark)**

(ii) Calculate the kinetic energy of the trolley at point A. **(1 mark)**

(iii) What is the potential energy of the trolley at point B? **(1 mark)**

(iv) Calculate the kinetic energy of the trolley at point B. **(1 mark)**

(v) Calculate the velocity of the trolley at point B. **(1 mark)**