SINGAPORE SPORTS SCHOOL
Learned Champions with Character

SINGAPORE SPORTS SCHOOL
PRELIMINARY EXAMINATION 2022
SECONDARY 4
NORMAL (ACADEMIC)

MARK SCHEME

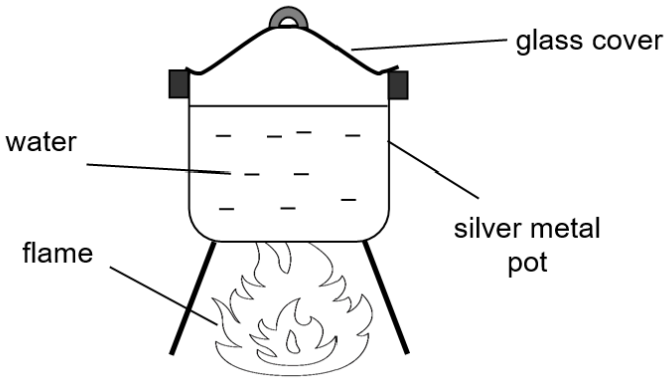
Q 1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	A	D	B	D	C	C	A	B	D

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	B	C	A	C	D	C	B	B	C

Section A

Answer **all** the questions in the spaces provided.

1 The diagram shows a silver metal pot filled with water and placed directly above a flame that heats the water until it boils.



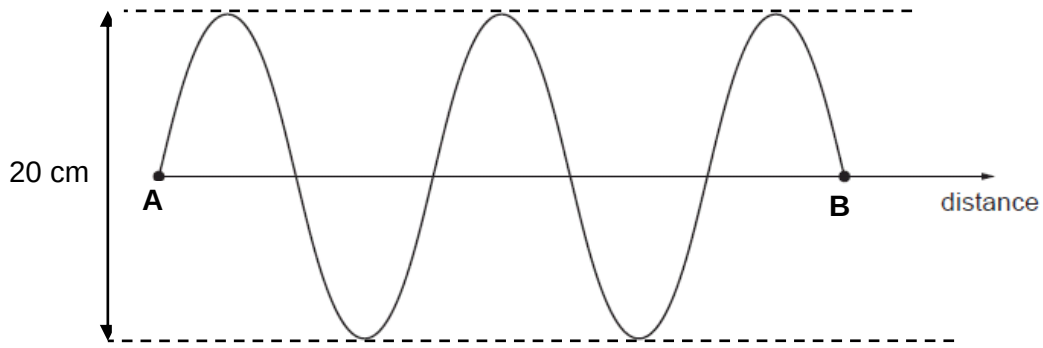
(a) Describe how heat is transferred throughout the water by convection.

When the water near the base of the pot is heated, it expands, beceomes less dense and rises. [1]
The cooler, denser water sinks to take its place. [1]
Process repeats, setting up convection currents, which heat up all the water in the metal pot. [1]

(b) What is the advantage of having a silver-coloured pot when boiling water?

Silver surface is a poor radiatorof infra-red radiation. [1]

2 The diagram shows a transverse wave travelling in air through points A and B.



The distance between **A** and **B** is 40 cm and wave speed is 3.2 m/s.

Determine

(a) the wavelength

wavelength = **16** cm **[1]**

(b) the amplitude,

amplitude = **10** cm [1]

(c) the frequency,

16 cm = 0.16 m

f = v / λ **[1]**

= 3.2 / 0.16

= 20 Hz **[1]**

frequency = ……... Hz [2]

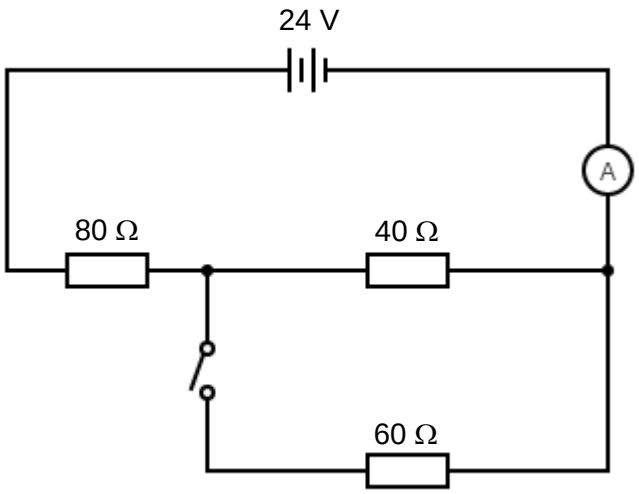
(d) the time taken for the wave to travel from **A** to **B**.

t = 40 / 320

= 0.125 s [1]

time = …… s [1]

3 A circuit is set up as shown.



(a) When switch S is opened,

(i) calculate the total resistance in the circuit.

80 + 40 = 120 Ω [1]

resistance = …….. Ω [1]

(ii) determine the current flowing through the ammeter.

I = V/R

= 24 /120 = 0.20 A [1]

current = …….. A [1]

(b) Switch S is then closed.

(i) Calculate the total resistance in the circuit.

$(1/40 + 1/60)^{-1}$ = 24 Ω [1]

24 + 80 = 104 Ω [1]

resistance = …… Ω [2]

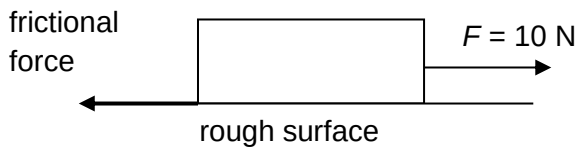
(ii) Will the reading of the ammeter be smaller, greater or the same as that in **(a)(ii)**?

Greater [1]

Section B

Answer any **two** questions from this section in the spaces provided.

4 A box of mass 2.0 kg is pushed horizontally on a rough surface by a 10 N force. The box moves at constant speed.

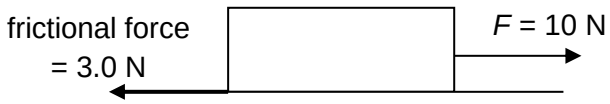


(a) State the magnitude of the frictional force acting on the box. Explain your answer.

10 N [1]

The acceleration of the box is 0 m/s^2.
Hence, resultant force acting on the box = 0 N. [1]

(b) The box of mass 2.0 kg is then pushed horizontally on a smoother surface by the same 10 N force. The frictional force on this surface is 3.0 N.



(i) Determine the resultant force acting on the box.

10 – 3 = 7 N [1]

resultant force = …….. N [1]

(ii) Calculate the acceleration produced by the resultant force in **b(i)**.

a = F / m

= 7 / 2 = 3.5 m/s^2 [1]

acceleration = ……. m/s^2 [1]

(iii) Given that the initial speed of the box is 2.0 m/s, calculate the time needed for the box to reach a speed of 16 m/s.

a = (v-u) / t

3.5 = (16 - 2) / t [1]

t = 4.0 s [1]

time = ... s [2]

(iv) Calculate the distance moved by the box as its speed increases from 2.0 m/s to 16 m/s.

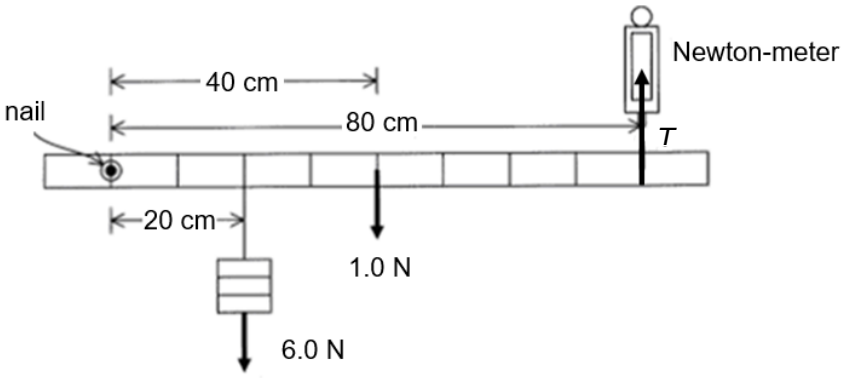
Distance = area under speed-time graph [1]

= (2 x 4) + (1/2 x 4 x14)

= 36 m [1]

distance = ... m [2]

5 **(a)** The diagram shows a metre rule of weight 1.0 N being pivoted on a nail passing through a hole drilled at the 10 cm mark. A weight of 6.0 N is suspended at the 30 cm mark. A Newton-meter supports the rule at the 90 cm mark so that it is horizontal.



(i) Using the principle of moments, calculate the magnitude of force *T* needed to keep the rule horizontal.

Total clockwise moment = 6 x 20 + (1x 40) = 160 Ncm [1]

Anti-clockwise moment = T x 80 [1]

T x 80 = 160

T = 2.0 N [1]

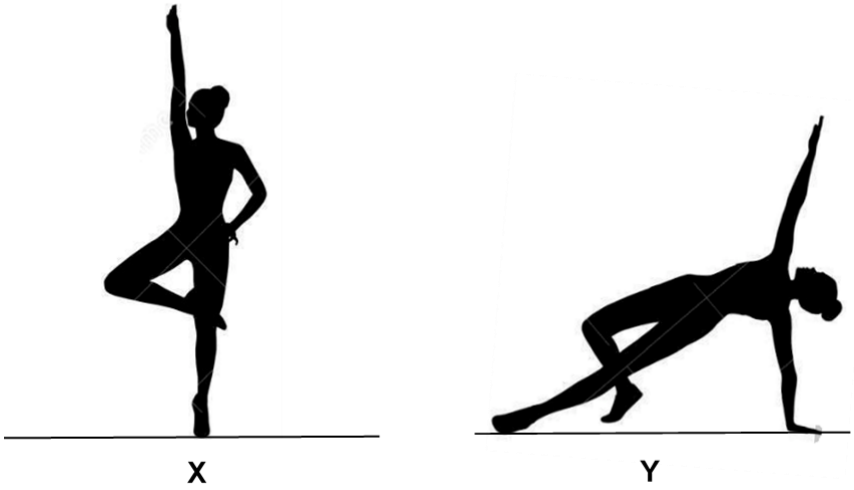
force *T* = …… N [3]

(ii) State and explain what happens to the force, *T,* when the 6.0 N weight is shifted further away from the nail.

Force T increases. [1]

When the 6.0 N weight is shifted further away from pivot, the total clockwise moment increases. Hence, force T has to increase to balance the greater clockwise moment. [1]

(b) The diagram shows the same gymnast in two different positions.



Which position, **X** or **Y**, is more stable?

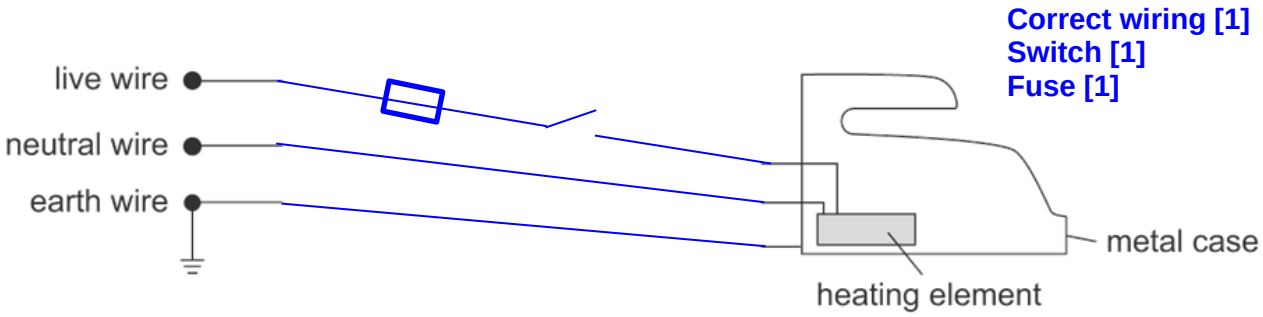
Y [1]

Give two reasons for your choice.

reason 1 **lower centre of gravity [1]**

reason 2 **bigger base [1]**

6 The diagram shows an electric kettle, which has a label '240 V, 1 440 W' marked on it. The kettle is connected to a 240 V mains supply by the live, neutral and earth wires.



Correct wiring [1]
Switch [1]
Fuse [1]

(a) Complete the diagram by drawing suitable wires to connect the kettle to the mains supply. Also, draw a fuse and a switch for the kettle. [3]

(b) The live, neutral and earth wires are connected to a three–pin plug. Complete the table to show the correct colour of the insulation for live and neutral wires.

wire	colour of insulation
live	**brown**
neutral	**blue [1]**

[1]

(c) **(i)** Calculate the current flowing in the live wire.

I = P/ V

= 1440 / 240 = 6.0 A [1]

current = …….. A [1]

(ii) Suggest a suitable fuse rating for this kettle based on your answer in (c)(i).

fuse rating = **7, 8, 9, 10** A [1]

(d) Describe one fault that may cause the fuse to melt and break the circuit.

Due to damaged insulation[1], exposed live wire touches the exposed earth wire/ exposed neutral wire/ metal casing. [1]

END OF PAPER