Candidate Name: ………………………..

Bedford School
16 + Entrants Exam

Paper: Physics

Time: 1 hour

Instructions to candidates
Write your Name in the space at the top of this page.

Answer the multichoice questions on the special sheet provided by ringing the answer with a pencil. Messy or untidy rings may not be marked.

Answer ALL written questions in the spaces provided on the question paper.

Information for candidates
The number of marks is given in brackets at the end of each question or part question.

The marks allocated and the spaces provided for your answers are a good indication of the length of answer required.

The multichoice section is worth 20 marks.
The written answer section is worth 50 marks.

Examiners Use		
Section A	**20**	
Section B		
Q1	10	
Q2	10	
Q3	10	
Q4	10	
Q5	10	
	50	
TOTAL	**70**	

Section A

This section consists of 20 multiple choice questions.

Answer these questions on the special sheet provided.

There is only ONE correct answer for each question.

1. Which factor does NOT affect the cooling rate of an object?
A. Temperature of object
B. Surface area of object
C. Temperature of surroundings
D. Melting point of object

2. How much energy is needed to produce a 10°C temperature rise for 1 kg of material with a SHC of 4000 Jkg^{-1}°C^{-1}?
A. 40000 J
B. 4000 J
C. 400 J
D. 40 J

3. Which of these statements is correct?
A. Temperature measures amount of heat energy
B. Temperature measures hotness
C. Heat energy measures hotness
D. Heat energy decreases with temperature

4. Latent Heat is the energy associated with what?
A. changing temperature
B changing state
C movement of particles
D work done in changing shape

5. When water boils, what happens to the water particles?
A. The bonds between them are broken
B. The particles get faster
C. The particles get slower
D. The bonds between them get stronger

6. Which of the following frequencies of a sound wave would have the shortest wavelength?
A. 5 Hz
B. 10 kHz
C. 15 kHz
D. 25 Hz

7. What is the speed of a wave with frequency 200 Hz and wavelength 1.5 m?
A. 100 m/s
B. 133 m/s
C. 250 m/s
D. 300 m/s

8. What is an analogue signal?
A. A signal made of a series of set values
B. A signal that cannot be affected by noise
C. A signal that has been sampled regularly
D. A signal made of a continuously varying wave

9. Which of the following statements about fibre optics is NOT true?
A. They can carry more information per second then copper wires
B. They use Total Internal Reflection to trap light
C. They carry electrical signals at the speed of light
D. They can be bent around very tight corners without losing information

10. What are the two types of electrostatic charge?
A. Positive and Negative
B. North and South
C. High and Low
D. Positive and Neutral

11. Which of the following is NOT an application of electrostatics?
A. Bicycle dynamo
B. Photocopying
C. Laser jet ink printers
D. Heart defibrillators

12. Given that V = IR, which of these statements about resistance is correct?
A. For a fixed resistance if voltage doubles then current will double too
B. For a fixed resistance if voltage doubles then current will halve
C. If voltage is unchanged and current has doubled then resistance has not changed
D. If voltage is unchanged and current has doubled then resistance has doubled too

13. Look at diagram 1, which of these statements is NOT true?
A. $I_1 = I_2 + I_3$
B. $I_3 = I_4$
C. $I_1 = I_2 + I_4$
D. $I_2 = I_3$

14. Which of these describes alpha radiation?
A. A single neutron
B. Two protons and two neutrons
C. A fast moving electron
D. An electromagnetic wave

15. Which of the following would be needed to absorb gamma radiation?
A. Thin paper
B. Thick lead
C. Thin aluminium
D. A few metres of air

Diagram 1

16. In which of the following medical applications is radiation being used as a "tracer"?
A. Killing small germs and bacteria on medical equipment
B. Taking images of the inside of someone's body using penetrative radiation
C. Injecting a small amount of radioactive material into blood to see how it moves
D. Bombarding a tumour with radiation to kill it off

17. The gradient of a distance-time graph gives what property?
A. Speed
B. Displacement
C. Acceleration
D. Momentum

18. Which of these is the definition of acceleration?
A. Change in speed over distance taken
B. Time taken over change in speed
C. Distance taken over change in speed
D. Change in speed over time taken

19. Which of the following statements about forces is NOT true?
A. When A exerts a force on B, B exerts and equal and opposite force on A
B. If no force is acting an object will gradually come to a halt
C. The acceleration of an object depends on the size of the force
D. If no force is acting an object carries on at a constant speed

20. Work done is a measure in what unit?
A. N
B. J
C. m / s
D. kg
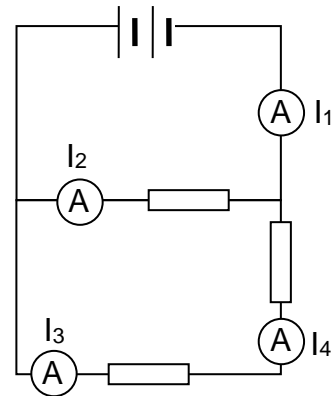
Answer sheet for Section A:

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D

11.	A	B	C	D
12.	A	B	C	D
13.	A	B	C	D
14.	A	B	C	D
15.	A	B	C	D
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D

SECTION B

1.   The manufacturer of a family car gave the following information.

Mass of car   950 kg.

The car will accelerate from 0 to 33 m/s in 11 seconds.

(a)   Calculate the acceleration of the car during the 11 seconds

....

....

Answer ....

(2)

(b)   Calculate the force needed to produce this acceleration.

....

....

....

(3)

(c)   It the car has four people in it, with a total extra mass of 200kg, for the same force as provided in part (b) what is the new acceleration going to be?

....

....

....

(2)

(d)   The manufacturer of the car claims a top speed of 110 miles per hour. Explain why there must be a top speed for any car.

....

....

....

(3)
(Total 10 marks)

2.   The diagram shows a fan heater.

grill
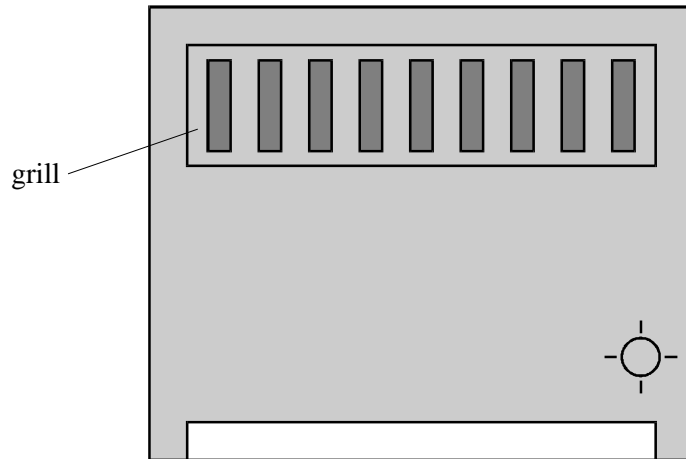
(a)   Complete this sentence.

The fan heater is designed to transfer electrical energy as ....

energy and .... energy.

(2)

(b)   The fan heater is connected to the mains by a three core cable.

(i)   Why are the wires in the cable made out of copper?

....

(ii)   Why are the wires in the cable covered by plastic?

....

(2)

(c)

You may find this equation useful when answering this part of the question
energy transferred (kWh) = power (kilowatt, kW) × time (hour, h)

(i)   The power of the fan heater is 2.75 kW.
Calculate how many kilowatt hours (kWh) of energy are transferred when the
fan heater is used for 6 hours.

....

....

Number of kilowatt hours ....

(2)

(ii) How much will it cost to use the fan heater for 6 hours if one Unit of electricity costs 7p?

....

....

Cost .... p

(2)

(d) A fault caused a much higher than normal current to flow in the heater. Describe what happened to the wire in the fuse.

....

....

....

(2)
(Total 10 marks)

3. Radio waves, ultra-violet, visible light and X-rays are all types of electromagnetic radiation.

(a) Choose wavelengths from the list below to complete the table.

3×10^{-8} m 1×10^{-11} m 5×10^{-7} m 1500 m

TYPE OF RADIATION	WAVELENGTH (m)
Radio waves	
Ultra-violet	
Visible light	
X-rays	

(4)

(b) Microwaves are another type of electromagnetic radiation.

Calculate the frequency of microwaves of wavelength 3 cm.
(The velocity of electromagnetic waves is 3×10^8 m/s.)

....

....

....

....

(3)

(c) Which type of electromagnetic radiation is used:

(i) to send information to and from satellites;

....

(ii) in sunbeds;

....

(iii) to kill harmful bacteria in foods?

....

(3)
(Total 10 marks)

4.   The drawing shows a section of a vacuum flask.
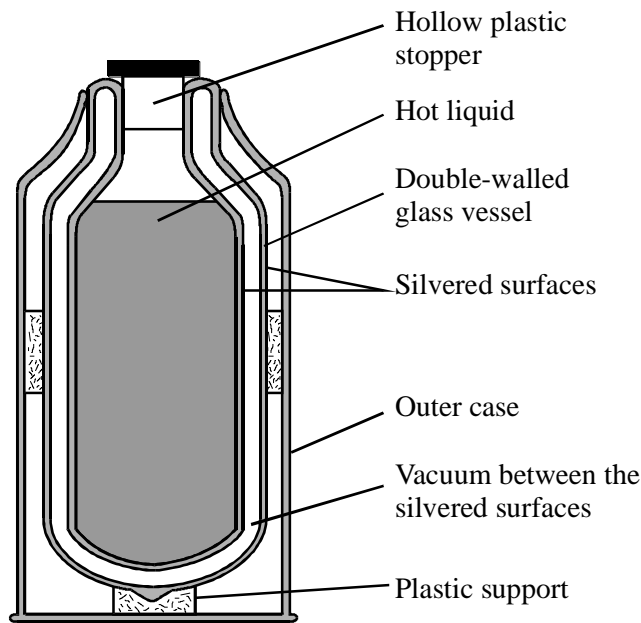
(a)   Heat is slowly "lost" from the hot liquid in the closed flask. It may be transferred by:

| conduction   convention   evaporation   radiation |

Choose from the words above to complete the following sentences. You may use a word once, more than once or not at all.

(i)   The vacuum between the glass walls reduces

.... and ....

(2)

(ii)   The silvered surfaces of the glass walls reduce

....

(1)

(iii)   The stopper in the opening of the flask reduces

.... and ....

(2)

(iv)   Heat is transferred by the air molecules, away from the vacuum flask, by

....

(1)

(v)   The plastic of the plastic stopper is preferred to metal because it cuts down

....

(1)

(b) Mark **X** on the diagram of the vacuum flask where the liquid in the flask is hottest.

(1)

(c) Explain, in terms of particles, how heat is conducted through a glass wall of the vacuum flask.

....

....

....

(2)
(Total 10 marks)

5. A crane on a barge lifts a girder and then carries it along the river.
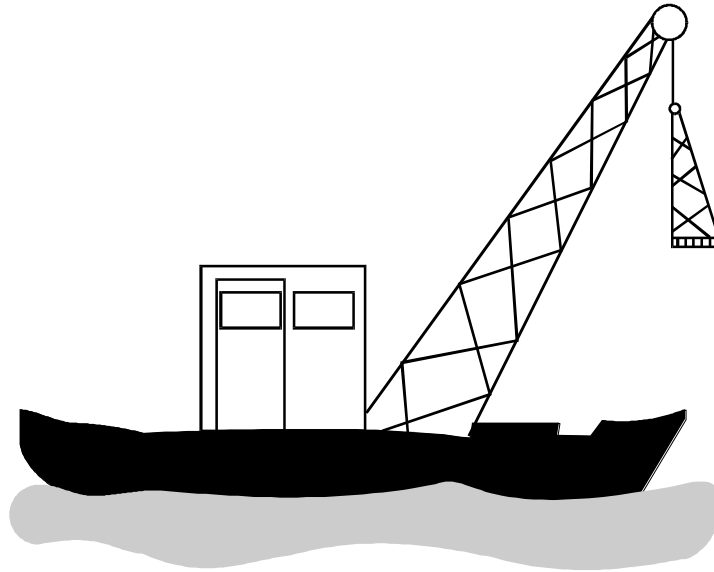
The girder has a weight of 1 000 000 N and is lifted to a height of 1500 cm.

(a) Complete the sentence.

The weight of the girder is caused by the Earth's gravitational field strength acting on its

....

(1)

(b) Calculate the work done in lifting the girder.

Write the equation you are going to use.

....

(1)

Show clearly how you work out your answer and give the unit.

....

....

....

....

....

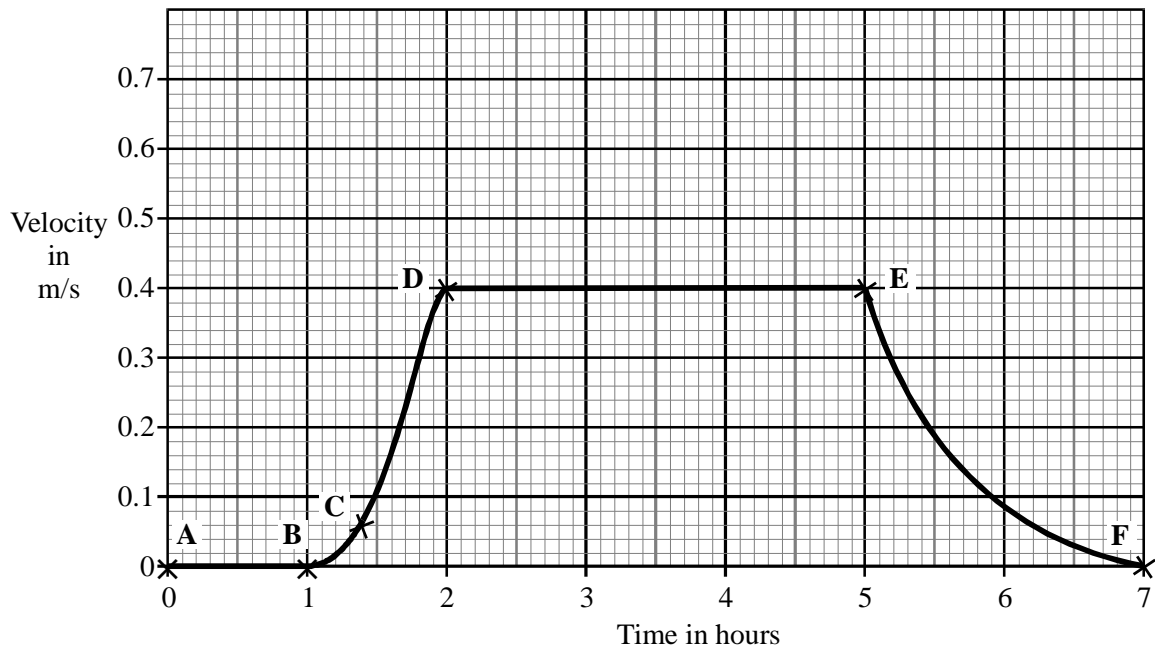Work done = ...

(3)

(c)   The velocity–time graph represents the motion of the barge after the girder had been lifted.

To gain full marks in this question you should write your ideas in good English. Put them in a sensible order and use the correct scientific words.

Describe the motion of the barge over this period of seven hours. You must refer to the points **A**, **B**, **C**, **D**, **E** and **F** in your description.

....

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....

....

....

....

(5)
(Total 10 marks)