Name _____

Shrewsbury School

SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION 2010

PHYSICS

(1 hour)

- **Attempt all questions.**
- **Spend about 20 minutes on section A and 40 minutes on section B**

NAME: ……

Multiple Choice Answer Sheet

For each question **circle** just one answer.

Question				
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 A: Multiple Choice (Spend about 20 minutes on this section)

1. An isotope of sodium can be represented by

$$^{23}_{11}Na$$

The number of neutrons in each nucleus of this isotope is

A 11

B 12

C 23

D 34

2. Complete the following sentence.
The planets of the solar system orbit the Sun at.....

A the same speed as each other

B faster speeds the further they are from the Sun

C slower speeds the further they are from the Sun

D a speed that depends on their mass

3. The image seen in a plane mirror is

A real and the right way up

B real but laterally inverted

C virtual but the right way up

D virtual but laterally inverted

4. Which of the following statements about sound is **not** true?

A sound can be refracted by layers of air

B sound can be reflected

C sound can travel through solid substances

D sound is a transverse wave

5. A woman of weight 600 N sits 1.5 m away from the pivot point of a see-saw. Her son weighs 400 N. How far from the pivot must he sit on the other side to balance the see-saw?

A 0.75 m

B 2.25 m

C 1.75 m

D 2.50 m

6. Molecules sometimes escape from the surface of a liquid and become gas molecules. What is this process called?

A Condensation

B Convection

C Evaporation

D Diffusion

7. Which of these sources of energy for generating electricity is affected by climate change?

A Hydro-electric

B Nuclear

C Geothermal

D Tidal

8. A shopping trolley is pushed a distance of 60 m with an average force of 30 N. How much work is done?

A 800 J

B 1800 W

C 3600 W

D 1800 J

9. Which of these is used for sterilising the instruments used in operating theatres?

A infra-red waves

B radio waves

C gamma rays

D X-rays

10. What is the output power of a machine which can do 30 kJ of work in one minute?

A 0.5 W

B 500 W

C 1800 W

D 30 kW

11. A lamp whose filament resistance is 3 ohm at its normal operating temperature carries a current of 4A. What is the power rating of the lamp?

A 12 W

B 48 W

C 0.75 W

D 36 W

12. The half life of a radioactive isotope is 12 hours. What fraction of the original isotope remains after 48 hours?

A 1/4

B 1/16

C 1/8

D 1/6

13. This information was attached to an electric toaster.

230V **50Hz**
1.5 kW

The correct size of fuse which should be fitted is

A 3 A

B 5 A

C 10 A

D 13 A

14. What is the name of the process which is responsible for the spreading of sound waves when they pass through a gap?

A interference

B refraction

C diffraction

D dispersion

15. Which of the following statements describes an alpha particle?

A one electron and two protons

B two protons and two neutrons

C two neutrons and two electrons

D one neutron and one proton

16. A student is doing an experiment on the rate of heat transfer from a beaker of hot water. Which of the following statements is true?

A The darker the colour of the beaker the slower the rate of heat transfer.

B The hotter the water the faster the rate of heat transfer.

C The shape of the beaker does not affect the rate of heat transfer.

D The temperature of the water does not affect the rate of heat transfer.

17. Which statement below best describes red-shift?

A A decrease in the frequency of light due to the galaxies moving closer to the Earth.

B A decrease in the frequency of light due to the galaxies moving away from the Earth.

C An increase in the frequency of light due to the galaxies moving closer to the Earth.

D An increase in the frequency of light due to the galaxies moving away from the Earth.

18. A train accelerates from a velocity of 5m/s to 30 m/s in a time of 20 s. What is the acceleration of the train?

A 1.25 m/s^2

B 1.75 m/s^2

C 1.50 m/s^2

D 2.25 m/s^2

19. Which selection below has the groups of the electromagnetic spectrum in the correct order of **decreasing** wavelength?

A radio waves; infra-red; ultra-violet; visible light

B radio waves; infra-red; ultra-violet; X-rays

C gamma rays; ultra-violet; visible light; radio waves

D infra-red; visible light; X-rays; radio waves

20. A cyclist and his bike have a mass of 100 kg. He is cycling at a speed of 20 m/s. What is his kinetic energy?

A 1000 J

B 2000 J

C 10 000 J

D 20 000 J

Section B (Spend about 40 minutes on this section)

21. A communications satellite orbits the Earth. Many systems in the satellite are powered by a solar panel. This consists of a flat area covered by many solar cells. Sometimes the power supplied by the solar cells is not enough for the satellite. Additional power is then supplied by rechargeable nickel-cadmium batteries. Later the solar panel is used to recharge these batteries.

(a) Describe the overall energy conversion occurring when radiation from the Sun falls on the solar panel.

(2)

(b) (i) The energy falling on one square metre of the solar panel every second is 1000 J. The total area of the solar panel is 20 m^2. Calculate the total energy falling on the panel every second.

(1)

(ii) Only 10% of this energy is converted into useful forms. Calculate the power available from the panel.

(2)

(iii) What happens to the energy not usefully converted by the solar cells?

(1)

(c) Describe the energy changes in the nickel-cadmium batteries while they are being charged.

(2)

The height of the satellite above the Earth is 36 000 km. Signals are transmitted to and from the satellite using microwaves. The signals from the Earth are sent using a frequency of 6 GHz. (1 GHz = 1 000 000 000 Hz and speed of microwaves = 3.0 x 10^8 m/s).

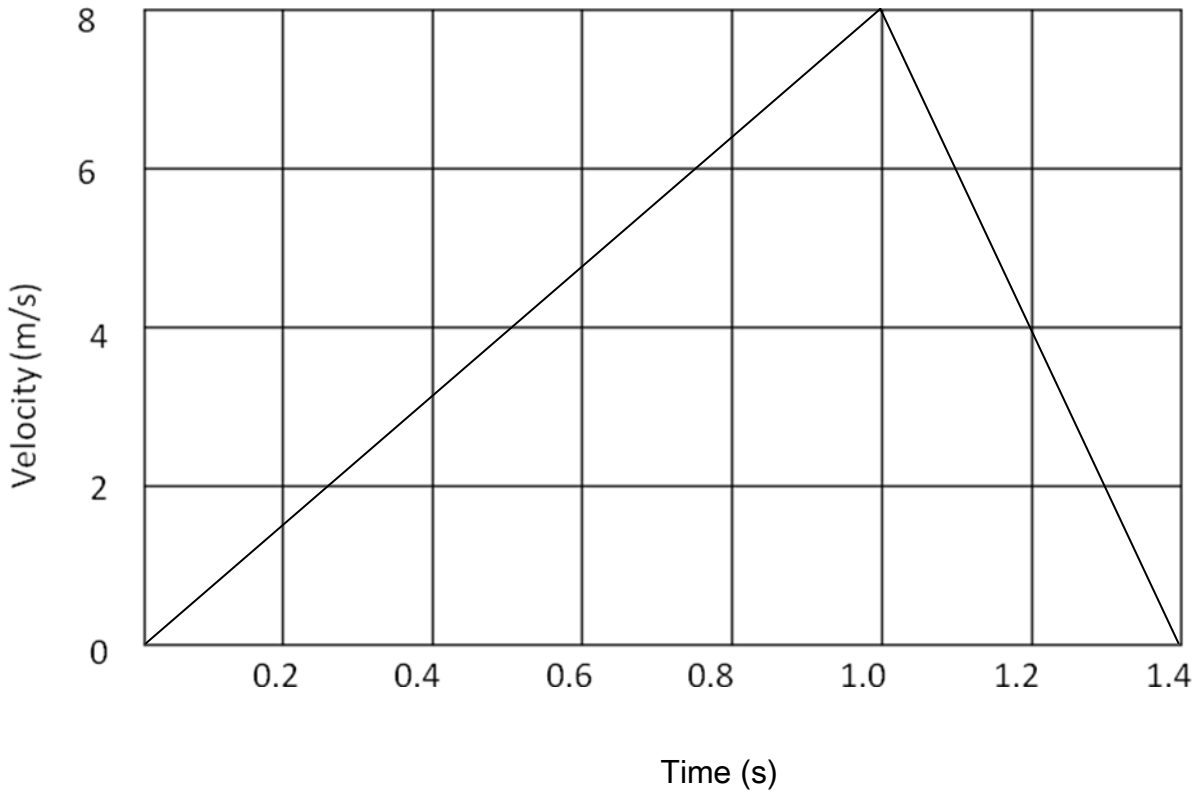
(d) Calculate the shortest time for the microwaves to travel from the satellite to Earth.

(3)

(e) Calculate the wavelength of these microwaves.

(2)

22. Ian has a mass of 70 kg. He dives from a high diving board. His vertical velocity at different times is shown in the graph below.



a) From the graph calculate:

i) the time that he took to reach the water

(1)

ii) Ian's maximum velocity

(1)

iii) the height of the diving board

(2)

iv) Ian's deceleration in the water

(3)

v) the decelerating force on Ian in the water

(2)

23. You have been asked to plan an investigation which you could carry out in a school laboratory to compare three different types of heat insulation which could be used for insulating a hot water tank.

a) Draw a labelled diagram of your experimental set-up you would use.

(4)

(b) Give details of all measurements to be taken.

(2)

(c) List any variables that must be kept constant in order to make it a fair test.

(2)

END OF QUESTIONS