Name _____

Shrewsbury School

SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION 2009

PHYSICS

(1 hour)

Instructions to candidates:

- **Attempt all questions.**
- **Spend about 30 minutes on section A and 30 minutes on section B**

NAME: .....

Multiple Choice Answer Sheet

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

Question					
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E

Section A: Multiple Choice. (Spend about 30 minutes on this section.)

1. A moon rock has a mass of 2.2 kg. It is brought back to Earth for investigation. Which line of the table gives the correct mass and weight of the rock on Earth?

   The gravitational field strength on the Earth is 10 N/kg.

	Mass on Earth	Weight on Earth
A	22 kg	2.2 N
B	2.2 kg	22 N
C	22 kg	220 N
D	2.2 kg	0.22 N

2. A car accelerates at 2.0 m/s^2 for 10s. How far does it travel?

A 10 m

B 20 m

C 50 m

D 100 m

3. An aircraft is travelling due south in straight horizontal flight at 100 m/s

Which of the following statements must be correct:

A The lift force is greater than the weight of the plane

B The drag force on the plane is equal to its weight

C The forward force from the jets is greater than the drag force

D The drag force is equal to the forward force from the jets

4. A rubber ball is dropped from a height onto a hard surface and bounces several times. Which line of the table gives the correct acceleration of the ball at the topmost point of its first bounce?

	Acceleration
A	0 m/s^2
B	0 m/s^2
C	10 m/s^2 down
D	10 m/s^2 up

5. Which is the best estimate of the volume of an adult elephant?

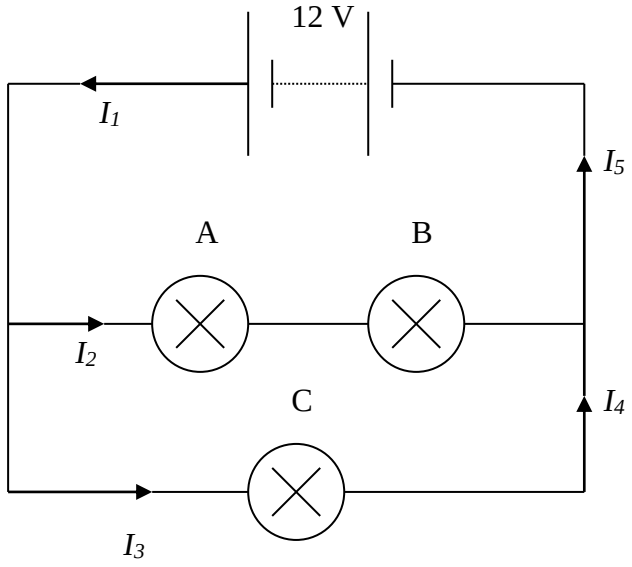
A 0.50 m^3

B 5.0 m^3

C 50 m^3

D 500 m^3

Questions 6-10 refer to the circuit diagram below. Lamps A, B and C are identical and have the same constant resistance of 24 ohms. The battery supplies a constant voltage of 12 V. I_1 to I_5 represent currents at different positions in the circuit.



6. Which of the following equations about currents is correct?

A $I_1 + I_5 = I_2 + I_3 + I_4$

B $I_4 = I_5 - I_2$

C $I_2 = I_3$

D $I_5 = 0$

7. What is the current through lamp C and the voltage across it?

A 0.50 A and 12.0 V

B 0.50 A and 6.0 V

C 2.0 A and 12.0 V

D 2.0 A and 6.0 V

8. Lamp C 'blows' (i.e. acts like a gap in the circuit). How does this affect lamps A and B?

A No effect

B They become brighter.

C They become dimmer

D They both go out.

9. What is the total current drawn from the battery?

A 0.50 A

B 0.75 A

C 1.0 A

D 1.5 A

10. Which of the statements below is NOT true about this circuit?

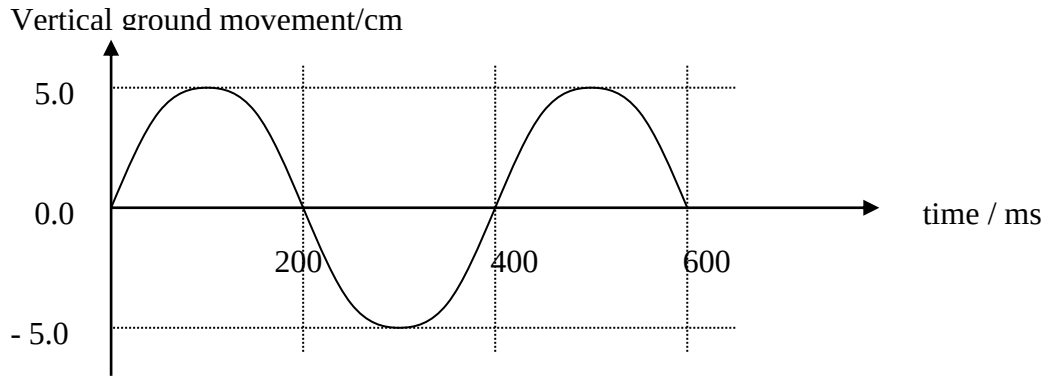
A The sum of the voltages across lamps A and B is equal to the voltage across the battery.

B The voltage across lamp C is equal to the voltage across the battery.

C The voltages across the two series lamps are equal.

D The voltage across the battery is equal to the voltage across every lamp in the circuit.

When an earthquake occurs energy travels away from the 'epicentre' as seismic waves. One type of seismic wave travels at about 5.0 km/s through rock. When this wave is detected at a monitoring station it produces the graph below.



Questions 11-14 refer to this graph.

11. What is the amplitude of the vertical ground movement?

A 200 ms

B 400 ms

C 5.0 cm

D 10.0 cm

12. What is the frequency of the seismic waves?

A 200 ms

B 400 ms

C 5.0 Hz

D 2.5 Hz

13. What is the wavelength of these waves?

A 400 ms

B 5 km

C 2000 m

D 5.0 cm

14. What is the best estimate of the maximum vertical speed of the ground during these vibrations?

A 1 cm/s

B 0.25 mm/s

C 5.0 km/s

D 50 cm/s

15. Gravity on the surface of the Moon is about 1/6 of the strength of gravity at the surface of the Earth. An astronaut has to lift rock samples into a buggy. Which of the statements below is correct:

A The mass of the rock is the same on the Moon so he has to do exactly the same amount of work as if he loaded them onto a similar buggy on Earth.

B The rock has about 1/6 of the mass it would have on Earth so he has to do about 1/6 of the work he would do if he loaded them onto a similar buggy on Earth.

C The weight of the rocks is the same on the Moon as on Earth so he has to do exactly the same amount of work as if he loaded them onto a similar buggy on Earth.

D The weight of the rocks on the Moon is about 1/6 of their weight on Earth so he has to do about 1/6 of the work he would do if he loaded them onto a similar buggy on Earth.

Questions 16-20 refer to the information given in the paragraph below.

Carbon-14 is a radioactive isotope of carbon. It decays by beta-emission and has a half life of about 6000 years. Most carbon consists of carbon-12 atoms which are stable. The ratio of carbon-14 to carbon-12 atoms is *R* :

$$R = \frac{\text{number of carbon-14 atoms}}{\text{number of carbon-12 atoms}}$$

This stays constant at a value R_0 in living things while they are alive, but once they die the carbon-14 is not replaced so the ratio changes. By measuring the ratio *R* in ancient artefacts we can date them (this is called 'radiocarbon dating').

16. What is meant by an 'isotope'

A A radioactive version of an atom.

B A different version of the same element having a different number of protons in its nucleus.

C A charged atom that has gained or lost electrons.

D A different version of the same element having a different number of neutrons in the nucleus.

17. What is a 'beta-particle'?

A A proton.

B A neutron.

C An electron.

D An electromagnetic wave.

18. An ancient wooden axe handle is 12 000 years old. What is the expected ratio *R* in the axe handle?

A R_0

B 0.50 R_0

C 0.25 R_0

D 4 R_0

19. A sample of cloth from an ancient tomb is found to have a ratio $R = 0.06$
What is the best estimate of its age?

A 6 000 years

B 12 000 years

C 18 000 years

D 24 000 years

20. Which one of the following could not be dated by this method?

A A wooden roof beam from a native American dwelling about 800 years old.

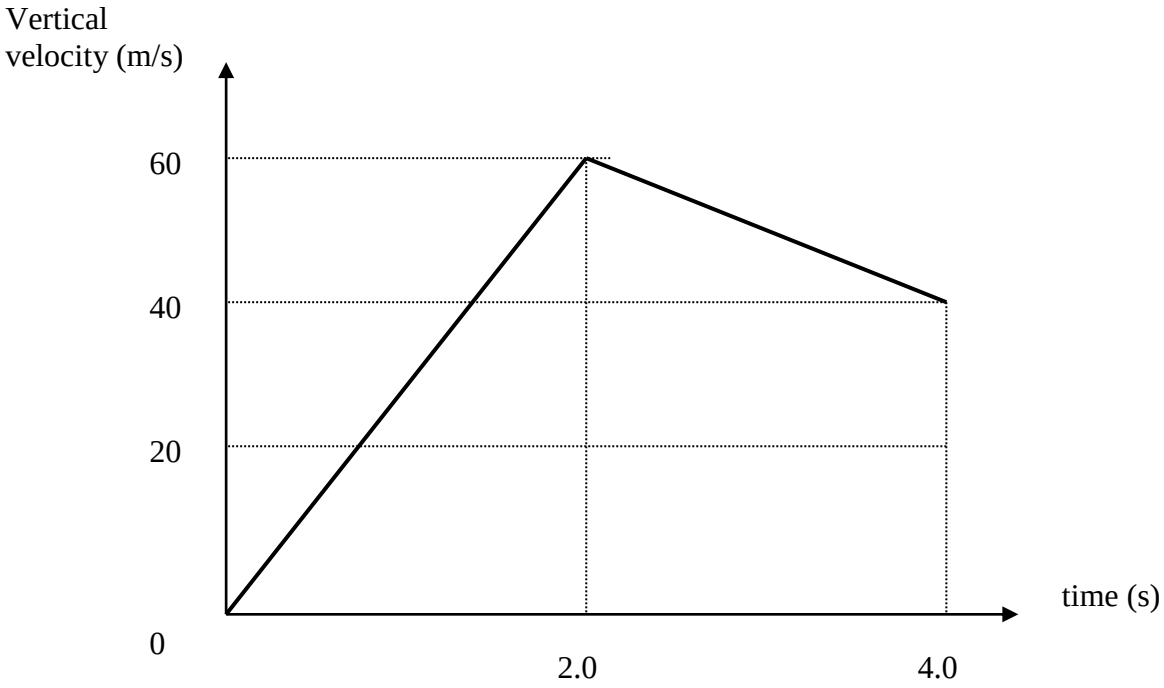
B Food remains found in a cave about 7500 years old.

C The jaw bone of a woolly mammoth about 14000 years old.

D A standing stone from an ancient stone circle about 3000 years old.

Section B (spend about 15 minutes on each question)

21. The diagram below shows an idealised velocity time graph for a model rocket for the first 30 s after launch. Air resistance has been ignored.



(a) Calculate the initial acceleration.

[3]

(b) At what time does the rocket motor switch off? Explain in terms of the forces acting on the rocket.

[3]

(c) Describe the motion of the rocket after 2.0 s.

[2]

(d) At what time would you expect the rocket to reach its maximum height? Explain your answer.

[3]

(e) What is the height of the rocket above the ground after 4.0 s? Explain how you work out your answer.

[4]

(f) How can you tell from the graph that this rocket was launched from the surface of the Earth and not from the surface of some other planet?

[2]

22. In this question you are asked to design an experiment that could be carried out to compare how good different surfaces are at absorbing thermal radiation from an infra-red heat lamp.

(a) List the apparatus you would need.

[3]

(b) Draw a labelled diagram of the experimental set-up you would use.

[4]

(c) State what measurements you would make and what instruments you would use to make these measurements.

[4]

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

[2]