



# MAGDALEN COLLEGE SCHOOL

## 16+ Entrance Exam: **Physics**

Time allowed: 45 minutes

Name: .....

Current school: .....

### Instructions

- Use **black** ink or ball-point pen.
- Attempt **all** questions.
- Use the **answer grid** to answer the questions.
- Write your name and school on both this booklet **and** the answer grid.
- Remember to transfer your answers to the answer grid before the end of the test.
- You may use the space between questions for rough working, but nothing written in this booklet will be marked.

### Information

- There is one mark per question. The total mark for this paper is 30. You will not lose marks for incorrect answers.
- Calculators are permitted.

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly.
- Try to answer every question.
- Check your answers if you have time at the end.

**Total** \_\_\_\_\_ /30 \_\_\_\_\_ %

1. A mass  $m$  is lifted at a constant speed.

The force of gravity when it is held in your hand is  $mg$ .

When it is being lifted, the force required is

- A Slightly less than  $mg$
  - B Equal to  $mg$
  - C Slightly more than  $mg$
  - D Dependent upon the speed
2. What is the best estimate of the energy required to lift a book to a high shelf?
- A 10 mJ
  - B 1 J
  - C 100 J
  - D 10 kJ
3. Which combination of units could result from a calculation to determine a force?
- A  $\text{Pa m}^2$
  - B  $\text{N m}$
  - C  $\text{kg m/s}$
  - D  $\text{m/s}^2$
4. A mass of 6.0 kg rests on the surface of a planet.  
On this planet, objects in freefall accelerate at  $20 \text{ m/s}^2$ .  
What is the weight of the object?
- A 0.30 N
  - B 6.0 N
  - C 12 N
  - D 60 N
  - E 120 N

5. A student measures the length of a spring. She then hangs different weights from the spring. She measures the length of the spring for each different weight.

The table shows her results.

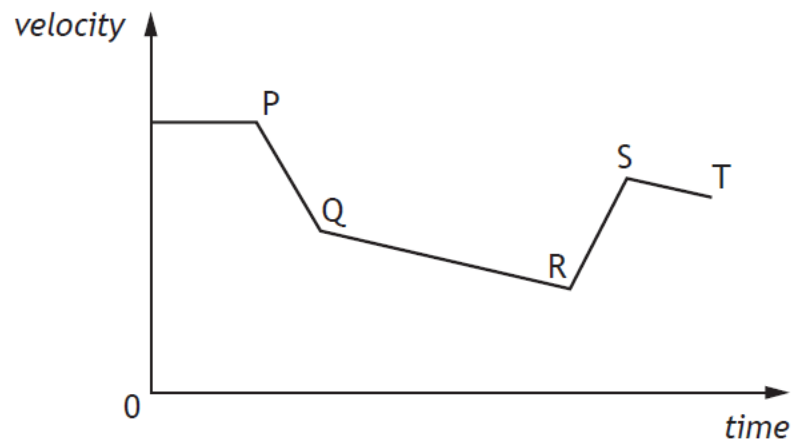
weight/N	length/mm
0	520
1.0	524
2.0	528
3.0	533
4.0	537
5.0	540

What is the extension of the spring when the weight hung from it is 3.0 N?

- A 4 mm
- B 5 mm
- C 12 mm
- D 13 mm
- E 533 mm

6. A cyclist is travelling along a straight road.

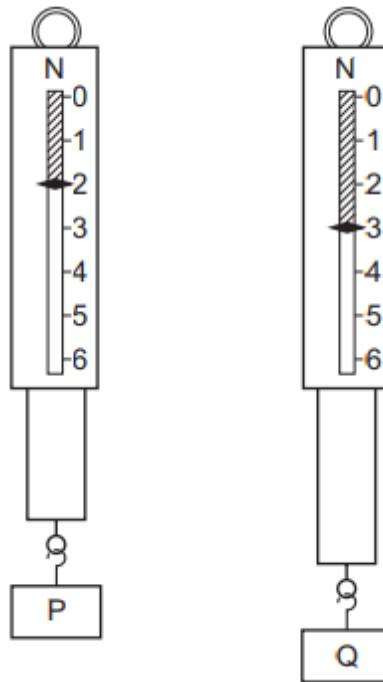
The graph shows how the velocity of the cyclist varies with time.



The kinetic energy of the cyclist is greatest at

- A P
- B Q
- C R
- D S
- E T

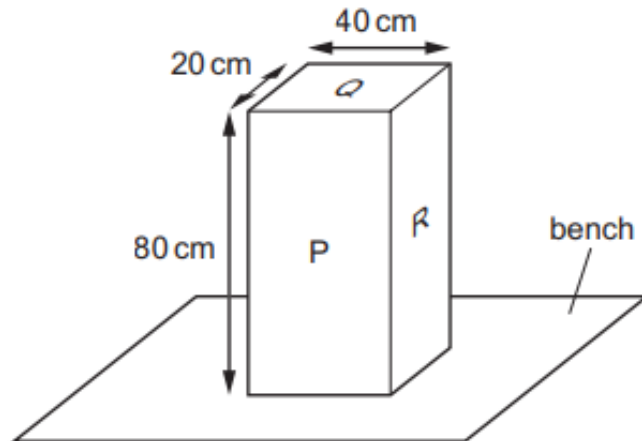
7. Two metal blocks P and Q have identical dimensions.  
They hang on identical spring balances.



Which statement about P and Q is correct?

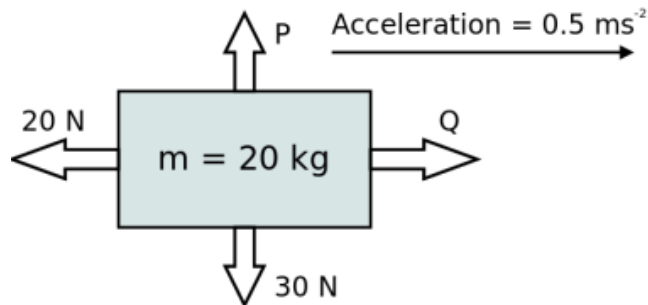
- A They have different volumes and different weights.
- B They have different volumes and equal weights.
- C They have equal volumes and equal weights.
- D They have equal volumes and different weights.

8. The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



On which labelled surface should the block rest to produce the smallest pressure on the bench?

- A P
  - B Q
  - C R
  - D P, Q and R produce the same pressure
9. An object with a mass of 20 kg accelerates at  $0.5 \text{ m/s}^2$  to the right as shown.



There are four forces acting on the object.

What are the correct values of the forces labelled P and Q?

	P / N	Q / N
A	20	20
B	20	30
C	30	10
D	30	20
E	30	30

10. A car travels 100 km. The journey takes two hours.

The highest speed of the car is 80 km / h, and the lowest speed is 40 km / h.

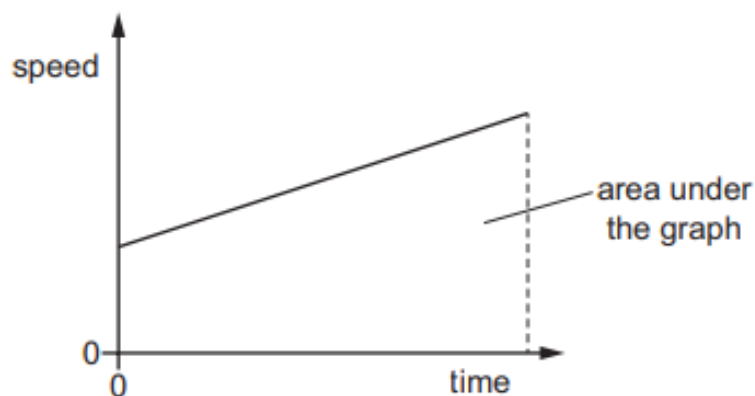
What is the average speed for the journey?

- A 40 km / h
- B 50 km / h
- C 60 km / h
- D 120 km / h

11. A book is placed on a table. According to Newton's Third Law, what force must always be equal and opposite to the weight of the book?

- A The support force from the table holding up the book
- B The contact force of the book on the table
- C The contact force on the table from the ground
- D The book's gravitational force on the earth
- E The friction between the book and the table

12. The motion of an object is represented by the speed–time graph shown.



Which quantity is equal to the area under the graph?

- A acceleration
- B average speed
- C distance travelled
- D kinetic energy

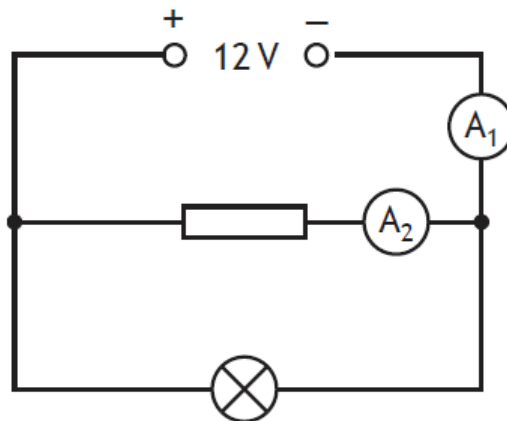
13. A car is travelling at 6.0 m/s along a straight level road.  
The car then accelerates uniformly at 2.0 m/s<sup>2</sup> for 4.0 s.  
The final speed of the car is

- A 8.0 m/s
- B 14 m/s
- C 22 m/s
- D 26 m/s
- E 48 m/s

14. A power supply of voltage  $V$  is connected to a resistance  $R$  for a time  $t$ .  
What equation correctly gives the energy  $E$  transferred during this time?

- A  $E = V R t$
- B  $E = V t / R$
- C  $E = V^2 t / R$
- D  $E = V^2 R t$

15. A circuit is set up as shown.

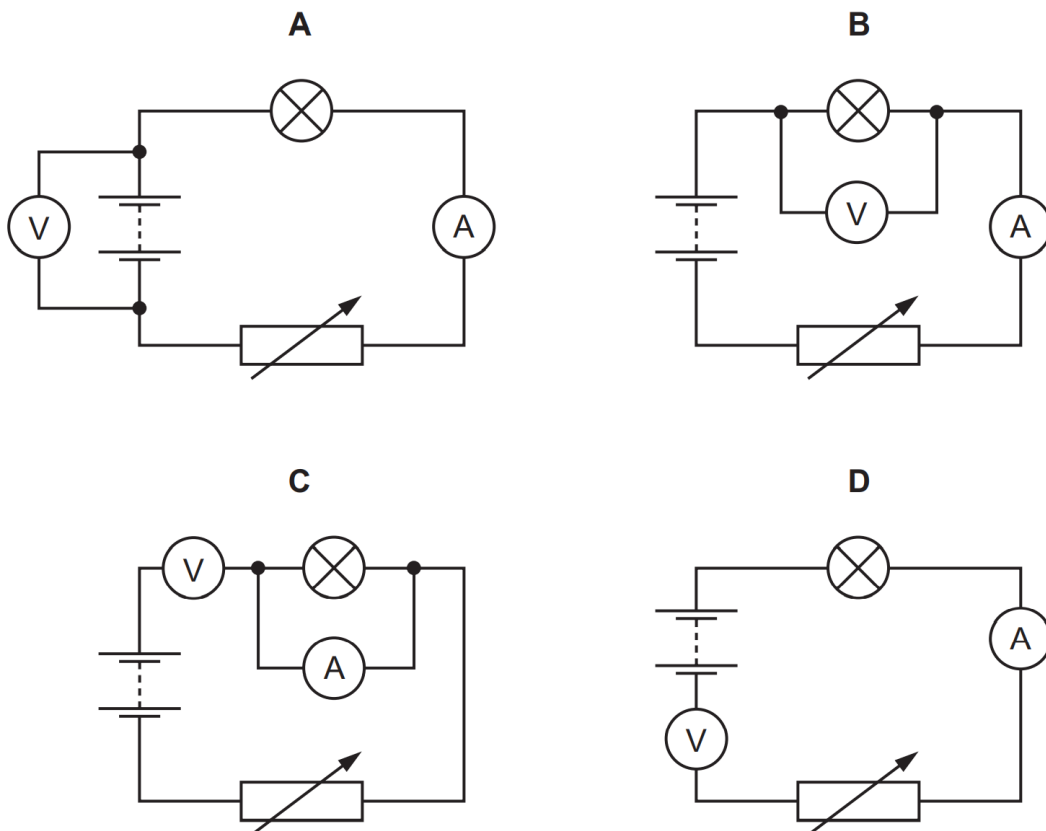


The reading on ammeter A<sub>1</sub> is 5.0 A. The reading on ammeter A<sub>2</sub> is 2.0 A.

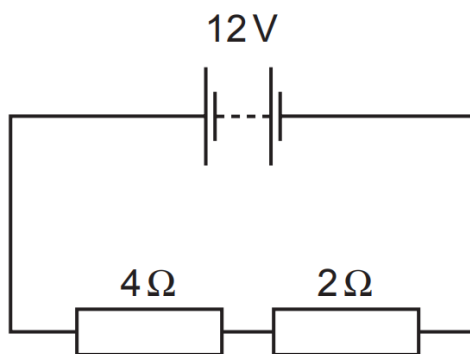
The charge passing through the lamp in 30 seconds is

- A 0.1 C
- B 10 C
- C 60 C
- D 90 C
- E 150 C

16. Which diagram shows the arrangement of the ammeter and voltmeter to obtain readings to investigate the characteristics of a lamp?



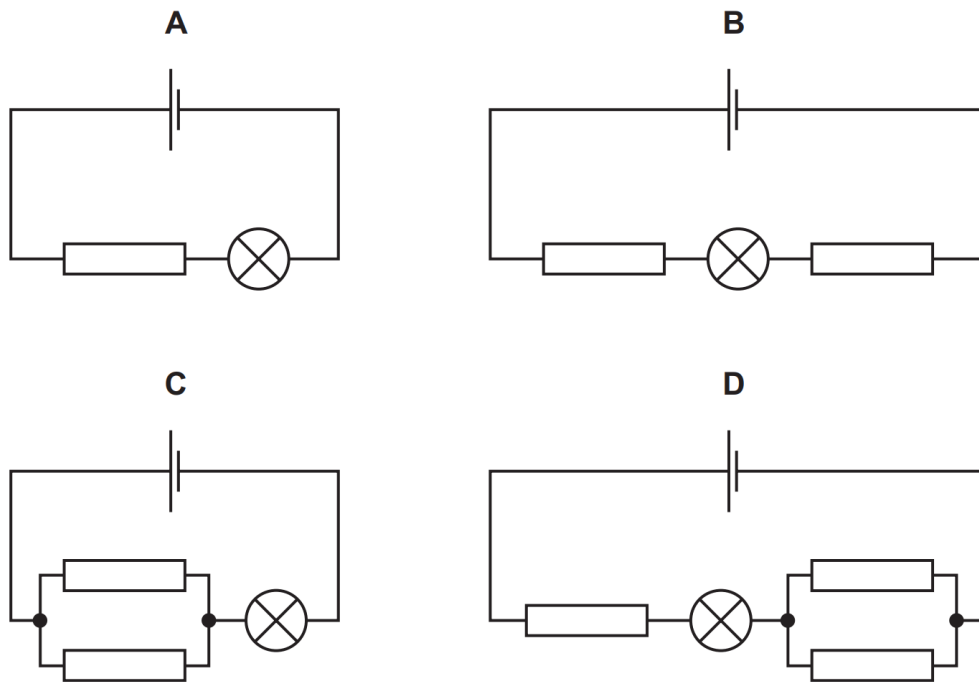
17. In the circuit shown, the potential difference (voltage) across the  $4\ \Omega$  resistor is  $8\ \text{V}$ .



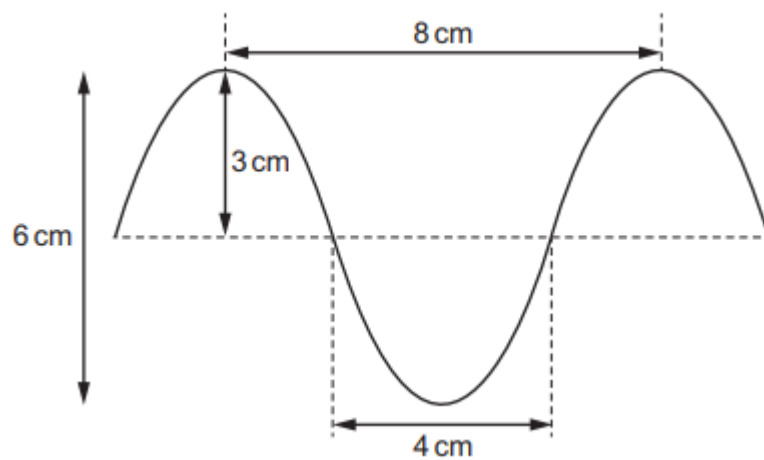
What is the p.d. across the  $2\ \Omega$  resistor?

- A  $4\ \text{V}$
- B  $6\ \text{V}$
- C  $8\ \text{V}$
- D  $16\ \text{V}$

18. The cells, lamps and resistors in the circuits are identical.  
In which circuit is the lamp the brightest?



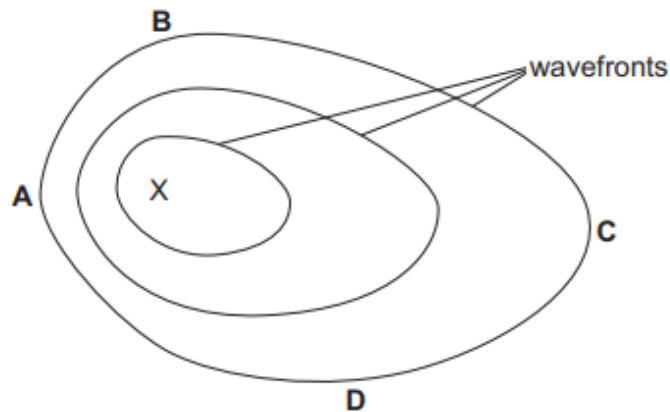
19. The diagram shows a wave.



What are the amplitude and the wavelength of this wave?

	amplitude / cm	wavelength / cm
<b>A</b>	3	4
<b>B</b>	3	8
<b>C</b>	6	4
<b>D</b>	6	8

20. Waves travel more quickly on the surface of water when the water is deep. A stone is dropped at point X into a pool of varying depth. The diagram shows the first three wavefronts on the surface of the pool. The region between X and which labelled point is likely to be the deepest?



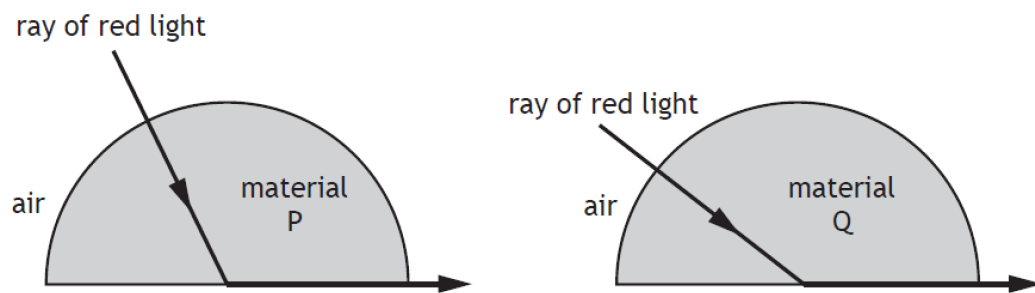
21. The period of vibration of a guitar string is 8 ms.  
The frequency of the sound produced by the guitar string is
- A 0.125 Hz
  - B 12.5 Hz
  - C 125 Hz
  - D 800 Hz
  - E 8000 Hz

22. The table below represents the electromagnetic spectrum.  
Some regions have been labelled, and some labels are missing.  
Which region should be labelled as ultra-violet waves?

radio waves	<b>A</b>	<b>B</b>	visible light	<b>C</b>	<b>D</b>	$\gamma$ -rays
-------------	----------	----------	---------------	----------	----------	----------------

23. Ultrasound is used in a hospital to scan a patient. Ultrasound refracts at the boundary between muscle and bone because it travels at a greater speed in bone. Which change takes place when the ultrasound travels from muscle into bone?
- A The frequency of the wave decreases.
  - B The frequency of the wave increases.
  - C The wavelength of the wave decreases.
  - D The wavelength of the wave increases.

24. Red light is used to investigate the critical angle of two materials P and Q.

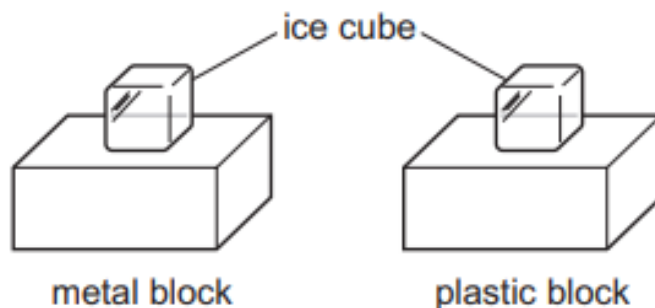


How does the speed of light differ between the two materials, and how does each compare to the speed of light in air?

- A Light is slower in P than in Q. In air, it is faster than in either material.
  - B Light is slower in Q than in P. In air, it is faster than in either material.
  - C Light is slower in P than in Q. In air, it is slower than in either material.
  - D Light is slower in Q than in P. In air, it is slower than in either material.
  - E The speed of light is equal in both materials, and in air.
25. A ray of light strikes a plane mirror at an angle of incidence of  $20^\circ$ .  
The angle of incidence is then increased by  $5^\circ$ .  
What is the new angle between the incident ray and the reflected ray?

- A  $10^\circ$
- B  $25^\circ$
- C  $45^\circ$
- D  $50^\circ$

26. One ice cube is placed on a metal block. An identical ice cube is placed on a plastic block. The blocks are left next to each other on a table in a laboratory.



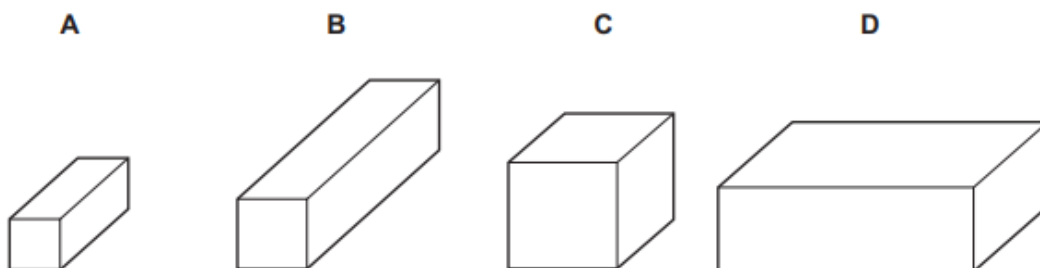
Which ice cube melts first and why?

- A The ice cube on the plastic block melts first because plastic is a good insulator of thermal energy.
  - B The ice cube on the plastic block melts first because plastic is a good conductor of thermal energy.
  - C The ice cube on the metal block melts first because metal is a good conductor of thermal energy.
  - D The ice cube on the metal block melts first because metal is a good insulator of thermal energy.
27. A gas is heated in a sealed container.

The volume of the container does not change.

What happens to the molecules of the gas?

- A The average distance between molecules increases.
  - B The average kinetic energy of the molecules increases.
  - C The mass of each molecule increases.
  - D The volume of each molecule increases.
28. The diagrams show four blocks of steel. The blocks are all drawn to the same scale. The same quantity of thermal energy is given to each block. Which block shows the greatest rise in temperature?



29. In which does thermal conduction not occur?

- A a gas
- B a liquid
- C a solid
- D a vacuum

30. A gas is cooled by 20 C, from an initial temperature of 10 C.

The final temperature in Kelvin is

- A 10 K
- B -10 K
- C 263 K
- E 273 K
- D 283 K

**END OF QUESTION PAPER**

# 16+ Physics: ANSWER GRID

Name: \_\_\_\_\_

Current School: \_\_\_\_\_

*For marker's use only:*

Mark

Check

You will have **45 minutes** for the test, which consists of 30 multiple choice questions.

Each correct answer scores 1 mark. You will not lose marks for incorrect answers.

For each question, select the correct answer and write the corresponding letter in the answer grid below. For example, if you think the correct answer to question 2 is B, you would fill in the grid as shown in **Example 1**. If you make a mistake, clearly cross out your wrong answer and write the correct one next to it, as shown in **Example 2**.

**Example 1:**

Question	Answer
2	B

**Example 2:**

Question	Answer
2	<del>B</del> D

There is space for working by each question. Remember to transfer your answers to the answer grid (below) before the end of the test.

**Answer grid - write your answers here before the end of the test.**

Question	Answer
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

*For marker's use only:*

--

Question	Answer
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

*For marker's use only:*

--

Question	Answer
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

*For marker's use only:*

--