Past Paper Multiple Choice Questions by Topic - Our Dynamic Universe

1. A train accelerates uniformly from $5{\cdot}0\ \mathrm{m\,s^{-1}}$ to $12{\cdot}0\ \mathrm{m\,s^{-1}}$ while travelling a distance of 119 m along a straight track. The acceleration of the train is

   A $0{\cdot}50\ \mathrm{m\,s^{-2}}$

   B $0{\cdot}70\ \mathrm{m\,s^{-2}}$

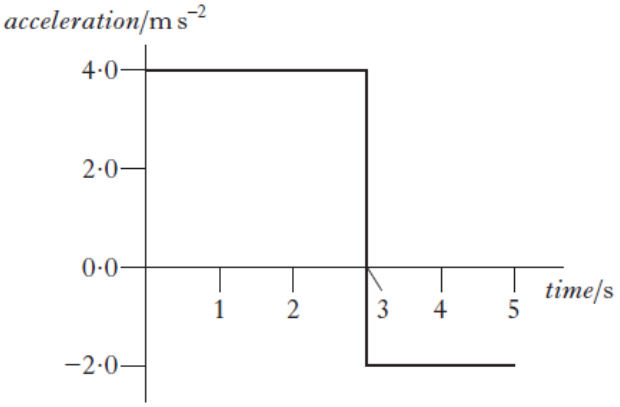
   C $1{\cdot}2\ \mathrm{m\,s^{-2}}$

   D $7{\cdot}0\ \mathrm{m\,s^{-2}}$

   E $14\ \mathrm{m\,s^{-2}}$.

2. An object starts from rest and accelerates in a straight line.

   The graph shows how the acceleration of the object varies with time.



   The speed of the object at 5 seconds is

   A $2\ \mathrm{m\,s^{-1}}$

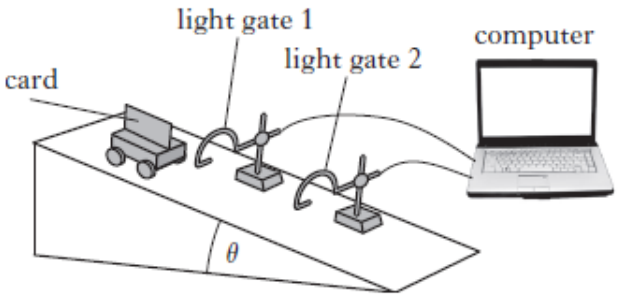
   B $8\ \mathrm{m\,s^{-1}}$

   C $12\ \mathrm{m\,s^{-1}}$

   D $16\ \mathrm{m\,s^{-1}}$

   E $20\ \mathrm{m\,s^{-1}}$.

3. A vehicle runs down a slope as shown.



   The following results are obtained.

   angle of slope,
   $\theta = 15{\cdot}0 \pm 0{\cdot}5°$

   length of card on top of vehicle,
   $d = 0{\cdot}020 \pm 0{\cdot}001$ m

   time for card to pass light gate 1,
   $t_1 = 0{\cdot}40 \pm 0{\cdot}01$ s

   time for card to pass light gate 2,
   $t_2 = 0{\cdot}25 \pm 0{\cdot}01$ s

   time for vehicle to travel between the light gates,
   $t_3 = 0{\cdot}50 \pm 0{\cdot}01$ s

   Which quantity has the largest percentage uncertainty?

   A θ

   B d

   C t_1

   D t_2

   E t_3

4. Two blocks are linked by a newton balance of negligible mass.

   The blocks are placed on a level, frictionless surface. A force of 18·0 N is applied to the blocks as shown.

   The reading on the newton balance is

   A 7·2 N

   B 9·0 N

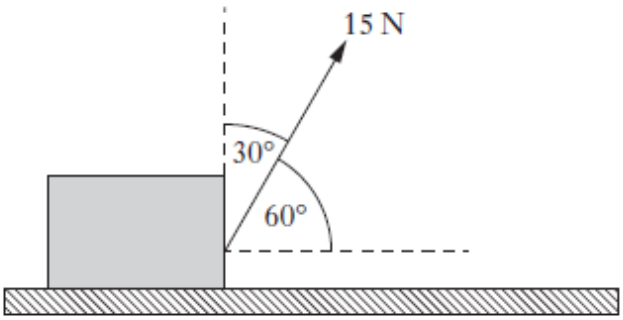
   C 10·8 N

   D 18·0 N

   E 40·0 N.

5. A box is placed on a horizontal surface.

A force of 15 N acts on the box as shown.



Which entry in the table shows the horizontal and vertical components of the force?

	Horizontal component/N	*Vertical component*/N
A	15 sin 60°	15 sin 30°
B	15 cos 60°	15 sin 30°
C	15 sin 60°	15 cos 60°
D	15 cos 30°	15 sin 30°
E	15 cos 60°	15 sin 60°

6. A cannon of mass $2{\cdot}0 \times 10^3$ kg fires a cannonball of mass 5·00 kg.

The cannonball leaves the cannon with a speed of 50·0 m s^{-1}.

The speed of the cannon immediately after firing is

A 0·125 m s^{-1}

B 8·00 m s^{-1}

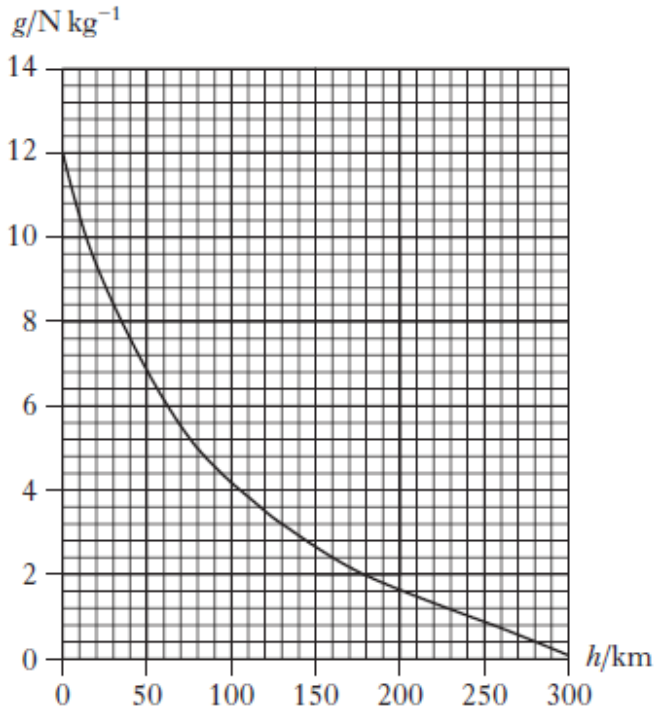
C 39·9 m s^{-1}

D 40·1 m s^{-1}

E 200 m s^{-1}.

7. A rock of mass 0·80 kg falls towards the surface of a planet.

The graph shows how the gravitational field strength, g, of the planet varies with height, h, above the surface of the planet.



At one point during its fall the weight of the rock is 4·0 N. The height of this point above the surface of the planet is

A 15 km

B 80 km

C 105 km

D 130 km

E 255 km.

8. An astronomer observes the spectrum of light from a star. The spectrum contains the emission lines for hydrogen.

The astronomer compares this spectrum with the spectrum from a hydrogen lamp. The line which has a wavelength of 656 nm from the lamp is found to be shifted to 663 nm in the spectrum from the star.

The redshift of the light from this star is

A 0·011

B 0·50

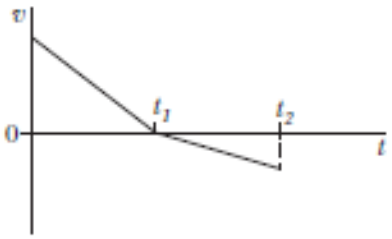
C 0·99

D 2·0

E 94.

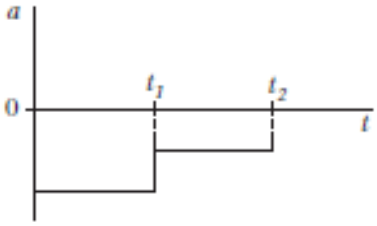
9. A trolley travels along a straight track.

The graph shows how the velocity v of the trolley varies with time t.

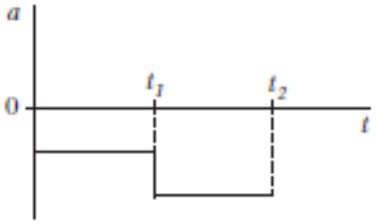


Which graph shows how the acceleration a of the trolley varies with time t?

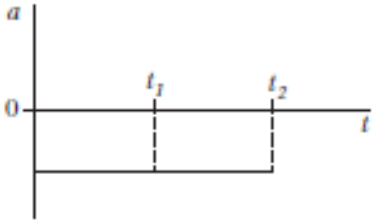
A



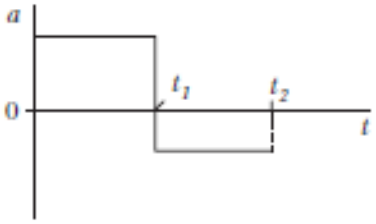
B



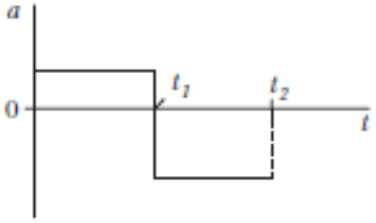
C



D



E



10. A rocket of mass 200 kg accelerates vertically upwards from the surface of a planet at $2{\cdot}0\ \mathrm{m\,s^{-2}}$.

The gravitational field strength on the planet is $4{\cdot}0\ \mathrm{N\,kg^{-1}}$.

What is the size of the force being exerted by the rocket's engines?

A 400 N

B 800 N

C 1200 N

D 2000 N

E 2400 N

11. The diagram shows the masses and velocities of two trolleys just before they collide on a level bench.

After the collision, the trolleys move along the bench joined together.

How much kinetic energy is lost in this collision?

A 0 J

B 6·0 J

C 12 J

D 18 J

E 24 J

12. A satellite orbits a planet at a distance of $5{\cdot}0 \times 10^7$ m from the centre of the planet.

The mass of the satellite is $2{\cdot}5 \times 10^4$ kg.

The mass of the planet is $4{\cdot}0 \times 10^{24}$ kg.

The gravitational force acting on the satellite due to the planet is

A $1{\cdot}7 \times 10^{-6}$ N

B $2{\cdot}7 \times 10^{3}$ N

C $1{\cdot}3 \times 10^{11}$ N

D $2{\cdot}7 \times 10^{14}$ N

E $2{\cdot}7 \times 10^{32}$ N.

13. The length of a spaceship at rest is L.

This spaceship passes a planet at a speed of $0{\cdot}95c$.

Which row in the table gives the measured lengths of the spaceship according to an observer on the spaceship and an observer on the planet?

	Length measured by observer on spaceship	*Length measured by observer on planet*
A	L	L
B	L	less than L
C	less than L	L
D	less than L	less than L
E	greater than L	less than L

14. A spacecraft travels at a constant speed of $0{\cdot}70c$ relative to the Earth.

A clock on the spacecraft records a flight time of 3·0 hours.

A clock on Earth records this flight time to be

A 1·6 hours

B 2·1 hours

C 4·2 hours

D 5·5 hours

E 5·9 hours.

15. A galaxy is moving away from the Earth at a velocity of $1{\cdot}20 \times 10^7$ m s^{-1}.

Light of wavelength 450 nm is emitted from this galaxy.

When detected and measured on Earth this light has a wavelength of

A 425 nm

B 432 nm

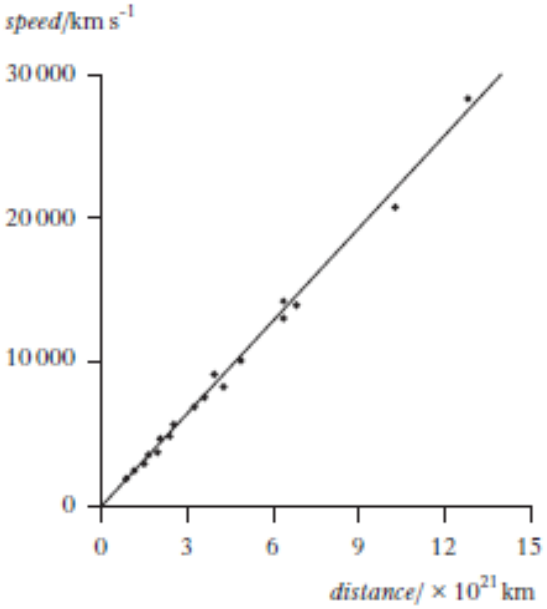
C 468 nm

D 475 nm

E 630 nm.

16. Galaxies at different distances from the Earth have been found to have different speeds.

The graph shows data for some distant galaxies.



A student studies this graph and makes the following statements.

I The speed of distant galaxies varies inversely with their distance from the Earth.

II The gradient of the line gives the value of Hubble's constant.

III The unit for Hubble's constant is s^{-1}.

Which of these statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only

17. A trolley has a constant acceleration of $3\,m\,s^{-2}$. This means that

A the distance travelled by the trolley increases by 3 metres per second every second

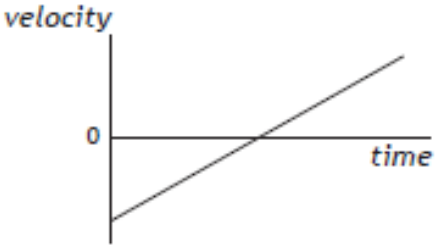
B the displacement of the trolley increases by 3 metres per second every second

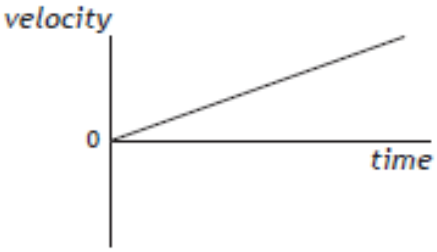
C the speed of the trolley is $3\,m\,s^{-1}$ every second

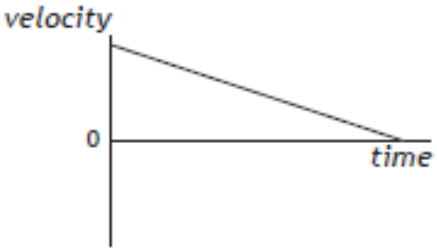
D the velocity of the trolley is $3\,m\,s^{-1}$ every second

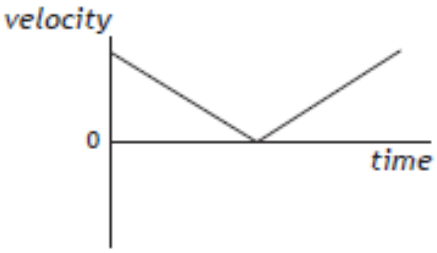
E the velocity of the trolley increases by $3\,m\,s^{-1}$ every second.

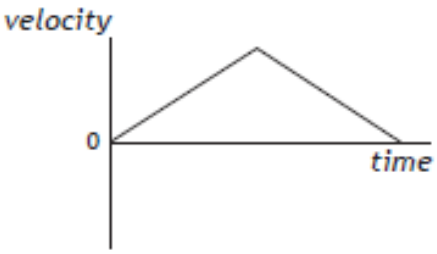
18. Which of the following velocity-time graphs represents the motion of an object that changes direction?

A


B


C


D


E


19. A football of mass 0·75 kg is initially at rest. A girl kicks the football and it moves off with an initial speed of 12 m s^{-1}. The time of contact between the girl's foot and the football is 0·15 s.

The average force applied to the football as it is kicked is

A 1·4 N

B 1·8 N

C 2·4 N

D 60 N

E 80 N.

20. Two small asteroids are 12 m apart.

The masses of the asteroids are $2{\cdot}0 \times 10^3$ kg and $0{\cdot}050 \times 10^3$ kg.

The gravitational force acting between the asteroids is

A $1{\cdot}2 \times 10^{-9}$ N

B $4{\cdot}6 \times 10^{-8}$ N

C $5{\cdot}6 \times 10^{-7}$ N

D $1{\cdot}9 \times 10^{-6}$ N

E $6{\cdot}8 \times 10^{3}$ N.

21. A spaceship on a launch pad is measured to have a length L. This spaceship has a speed of $2{\cdot}5 \times 10^8$ m s^{-1} as it passes a planet.

Which row in the table describes the length of the spaceship as measured by the pilot in the spaceship and an observer on the planet?

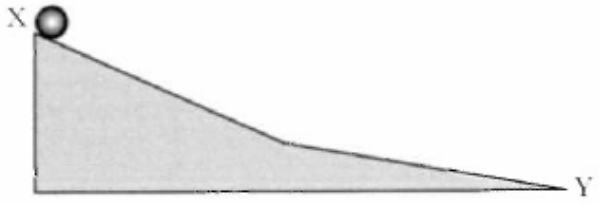
	Length measured by pilot in the spaceship	*Length measured by observer on the planet*
A	L	less than L
B	L	greater than L
C	L	L
D	less than L	L
E	greater than L	L

22. The siren on an ambulance is emitting sound with a constant frequency of 900 Hz. The ambulance is travelling at a constant speed of 25 m s^{-1} as it approaches and passes a stationary observer. The speed of sound in air is 340 m s^{-1}.

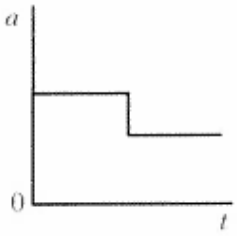
Which row in the table shows the frequency of the sound heard by the observer as the ambulance approaches and as it moves away from the observer?

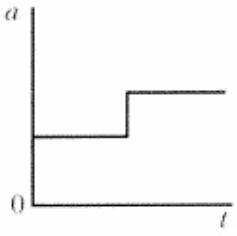
	Frequency as ambulance approaches (Hz)	*Frequency as ambulance moves away* (Hz)
A	900	900
B	971	838
C	838	900
D	971	900
E	838	971

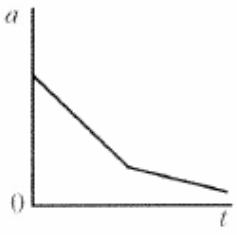
23. A ball moves down a frictionless slope from X to Y.

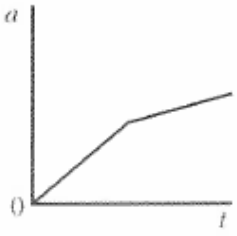


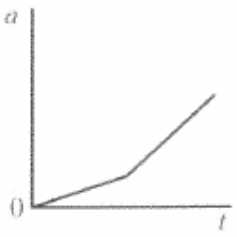
Which graph shows how the acceleration a of the ball varies with time t as it moves down the slope?

A


B


C


D


E


22. A boat is moving at a speed of 6·0 $m\,s^{-1}$. The boat now accelerates at 3·0 $m\,s^{-2}$ until it reaches a speed of 12 $m\,s^{-1}$.

The distance travelled by the boat during this acceleration is

A 6·0 m

B 18 m

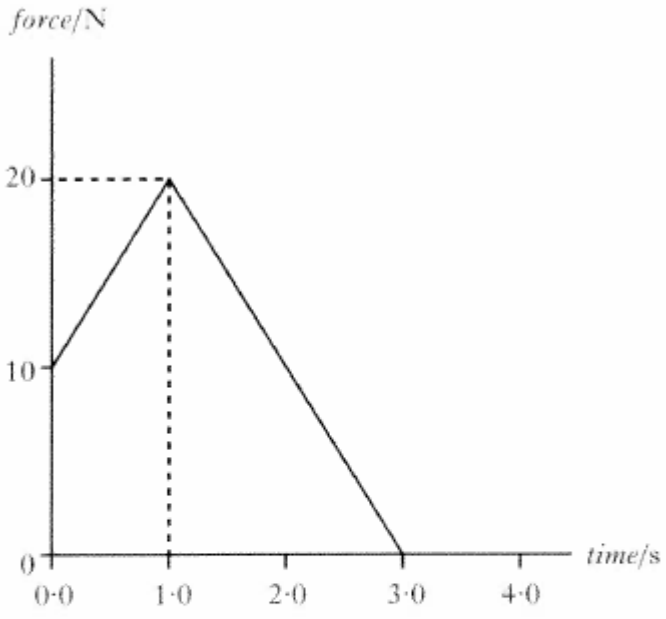
C 30 m

D 36 m

E 54 m.

25.

The graph shows how the force acting on an object of mass 5·0 kg varies with time.



The change in momentum of the object is

A 7·0 $kg\,m\,s^{-1}$

B 30 $kg\,m\,s^{-1}$

C 35 $kg\,m\,s^{-1}$

D 60 $kg\,m\,s^{-1}$

E 175 $kg\,m\,s^{-1}$.

26. A spaceship is moving with a constant speed of $0{\cdot}6c$ towards the Earth. The spaceship emits a beam of light towards the Earth. An astronaut in the spaceship and an observer on Earth both measure the speed of the emitted light.

Which row in the table shows the speed of the emitted light as measured by the astronaut and by the observer on Earth?

	Speed of emitted light as measured by astronaut	*Speed of emitted light as measured by observer on Earth*
A	$0{\cdot}4c$	$1{\cdot}6c$
B	c	c
C	c	$1{\cdot}6c$
D	$1{\cdot}6c$	$0{\cdot}4c$
E	$1{\cdot}6c$	c

27. Astronomers use the following relationship to determine the distance, d, to a star.

$$b = \frac{L}{4\pi d^2}$$

For a particular star the following data is recorded:

apparent brightness, $b = 4{\cdot}4 \times 10^{-10}$ W m^{-2}

luminosity, $L = 6{\cdot}1 \times 10^{30}$ W

Based on this information, the distance to this star is

A $3{\cdot}3 \times 10^{19}$ m

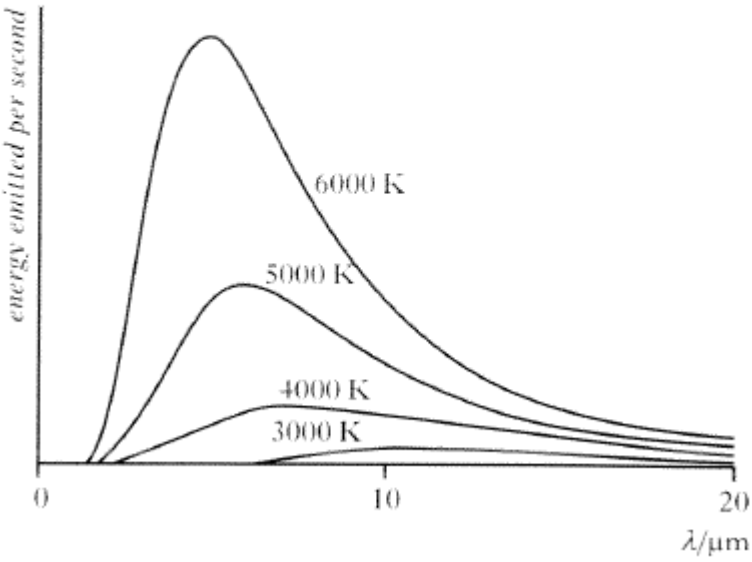
B $1{\cdot}5 \times 10^{21}$ m

C $3{\cdot}7 \times 10^{36}$ m

D $1{\cdot}1 \times 10^{39}$ m

E $3{\cdot}9 \times 10^{39}$ m.

28. The graph shows how the energy emitted per second from the surface of a hot object varies with the wavelength, λ, of the emitted radiation at different temperatures.



A student makes the following statements based on the information shown in the graph.

I As the temperature of the object increases, the total energy emitted per second decreases.

II As the temperature of the object increases, the peak wavelength of the emitted radiation decreases.

III The frequency of the emitted radiation steadily increases as the emitted energy per second decreases.

Which of the statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only

29. The cooling of the Universe and cosmic microwave background radiation provide evidence for

A the photoelectric effect

B the Bohr model of the atom

C the theory of special relativity

D the Big Bang theory

E Newton's Universal Law of Gravitation.

Answers and Original Source of Question

Question Number	Answer	Source
1	A	Revised Higher 2013 Q1
2	B	Revised Higher 2013 Q2
3	B	Revised Higher 2013 Q3
4	A	Revised Higher 2013 Q4
5	E	Revised Higher 2013 Q5
6	A	Revised Higher 2013 Q6
7	B	Revised Higher 2013 Q7
8	A	Revised Higher 2013 Q8
9	A	Revised Higher 2012 Q1
10	C	Revised Higher 2012 Q2
11	C	Revised Higher 2012 Q3
12	B	Revised Higher 2012 Q4
13	B	Revised Higher 2012 Q5
14	C	Revised Higher 2012 Q6
15	C	Revised Higher 2012 Q7
16	E	Revised Higher 2012 Q8
17	E	CfE Higher Specimen Q1
18	A	CfE Higher Specimen Q2
19	D	CfE Higher Specimen Q3
20	B	CfE Higher Specimen Q4
21	A	CfE Higher Specimen Q5
22	B	CfE Higher Specimen Q6
23		Revised Higher 2014 Q1
24		Revised Higher 2014 Q2
25		Revised Higher 2014 Q3
26		Revised Higher 2014 Q4
27		Revised Higher 2014 Q7
28		Revised Higher 2014 Q5
29		Revised Higher 2014 Q6