Teacher Resource Bank

GCE Physics A

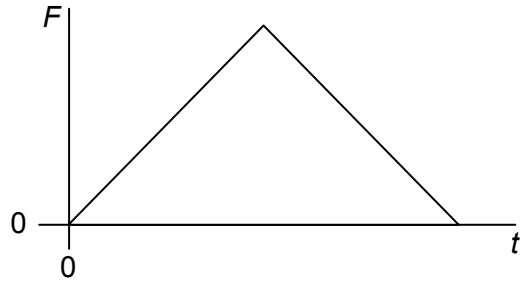
PHYA4 Section A Specimen Question Paper

AQA Physics Specification A – PHYA4, Section A, Sample Question Paper

Multiple choice questions

Each of Questions **1** to **30** is followed by four responses, **A, B, C,** and **D**. For each question select the best response and mark its letter on the answer sheet.

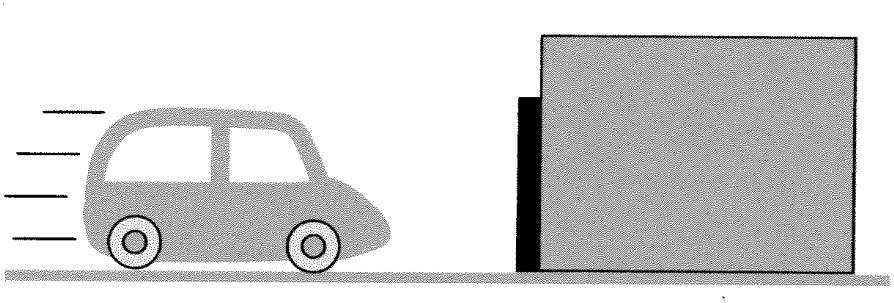
1 When a tennis player hits a returning ball of known mass with a racket, the force, *F*, exerted on it at time *t* can be represented by the following graph.



Which one of the following **cannot** be obtained from the graph?

A the change in momentum of the ball
B the impulse given to the ball
C the speed of the ball as it leaves the racket
D the acceleration of the ball at any given time

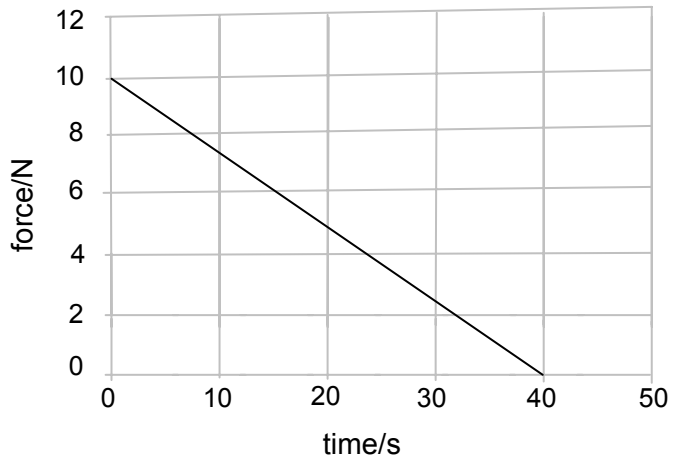
2 In a vehicle impact test, a car of mass 1200 kg travelling at a velocity of 18 m s^{-1} is stopped by a large concrete block. A forcemeter attached to the block is used to measure the average force of the impact.



The forcemeter measured an average force of 240 kN. What was the duration of the impact?

A 0.090 s
B 0.18 s
C 0.90 s
D 1.8 s

3 The graph shows how the force acting on a body changes with time.



The body has a mass of 0.25 kg and is initially at rest. What is the average acceleration of the body assuming no other forces are acting?

A 0.25 m s^{-2}
B 1.0 m s^{-2}
C 20 m s^{-2}
D 40 m s^{-2}

4 A cricket ball of mass 0.20 kg moving at 6.0 m s^{-1} is caught and brought to rest in 0.30 s. What is the average force exerted on the ball?

A 0.40 N
B 4.0 N
C 6.0 N
D 9.0 N

5 Which one of the following statements is correct?

In an inelastic collision

A momentum is conserved but kinetic energy is not conserved.
B momentum is not conserved but kinetic energy is conserved.
C both momentum and kinetic energy are conserved.
D neither momentum nor kinetic energy is conserved.

6 An object of mass 200 g, moving with a velocity *u*, collides with a stationary object of mass 300 g. If they stick together in the collision, what is the value of the ratio

$$\left(\frac{\text{kinetic energy after the collision}}{\text{kinetic energy before the collision}}\right)?$$

A $\frac{1}{1}$

B $\frac{2}{5}$

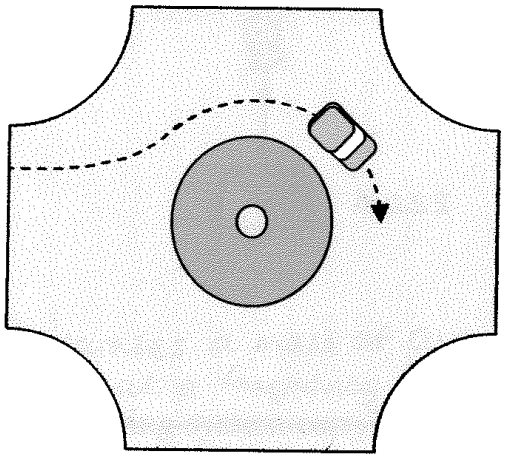
C $\frac{1}{16}$

D $\frac{1}{25}$

7 A tennis ball of mass 5.0×10^{-2} kg moves at 12 ms^{-1} perpendicularly towards a tennis racket. After being hit by the racket the ball rebounds along the same line at 18 ms^{-1}. What is the change in the momentum of the ball?

A 0.30 N s directed towards the racket
B 0.30 N s directed away from the racket
C 1.5 N s directed towards the racket
D 1.5 N s directed away from the racket

8 A car moves round a roundabout at a steady speed.



Which one of the following statements about the centripetal force *F* is **incorrect**?

A *F* is perpendicular to the momentum of the car.
B *F* is in the same direction as the acceleration of the car.
C *F* is equal to the product of the momentum and the angular speed of the car.
D *F* is equal to the product of the mass and the angular speed of the car.

9 A body is in simple harmonic motion of amplitude 0.50m and period 4π seconds. What is the speed of the body when the displacement of the body is 0.30 m?

A $0.10\,\mathrm{m\,s^{-1}}$
B $0.15\,\mathrm{m\,s^{-1}}$
C $0.20\,\mathrm{m\,s^{-1}}$
D $0.40\,\mathrm{m\,s^{-1}}$

10 To find a value for the acceleration of free fall, *g*, a student measured the time of oscillation, *T*, of a simple pendulum whose length, *l*, is changed. The student used the results to plot a graph of T^2 (*y* axis) against *l* (*x* axis) and found the slope of the line to be *S*. It follows that *g* is

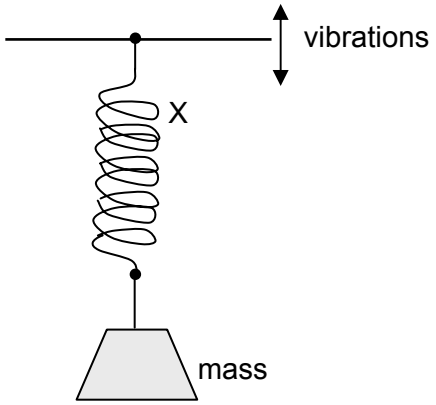
A $\frac{4\pi^2}{S}$.

B $4\pi^2 S$.

C $\frac{2\pi}{S}$.

D $2\pi S$.

11



A mass-spring system carries a mass of 0.40kg. When the point of suspension is made to vibrate vertically at a frequency of 15 Hz, resonance occurs. What mass should be **added to** the 0.40kg in order to reduce the resonant frequency to 10Hz?

A 0.20kg
B 0.40kg
C 0.50kg
D 0.60kg

12 The mass of a particular planet is 10% of the mass of the Earth and its radius is 50% of the radius of the Earth. What is the gravitational field strength at the surface of this planet?

A 0.98 N kg^{-1}
B 2.0 N kg^{-1}
C 3.9 N kg^{-1}
D 5.9 N kg^{-1}

13 Satellites R and S move in different stable circular orbits around the Earth. The orbital period of R is smaller than the orbital period of S. Which one of the following quantities must be greater for S than for R?

A mass
B momentum
C kinetic energy
D potential energy

14 A satellite of mass *m* moves along a circular orbit of diameter *D* above the surface of a planet. If the time period of the satellite is *T*, what is the kinetic energy of the satellite?

A $\frac{\pi^2 m D}{2T}$

B $\frac{\pi^2 m D^2}{2T}$

C $\frac{\pi^2 m D^2}{2T^2}$

D $\frac{\pi^2 m D}{2T^2}$

15 The force between two point charges when at a certain separation is *F.* When the distance between them is changed to 200 mm, the force between them becomes $\frac{F}{9}$. What was the distance between the two charges originally?

A 20mm
B 25mm
C 67mm
D 100mm

16 An electron, of charge *e* and mass *m*, starts from rest and is accelerated through a potential difference *V*. What is the final velocity of the electron?

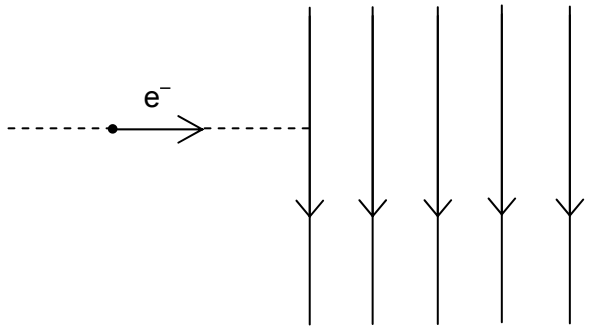
A $\frac{eV}{m}$

B $\frac{2eV}{m}$

C $\sqrt{\frac{2eV}{m}}$

D $V\sqrt{\frac{e}{m}}$

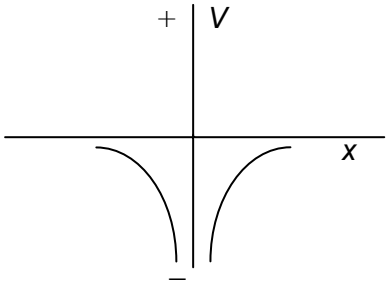
17 An electron travelling horizontally enters a uniform electric field which is directed vertically downwards.



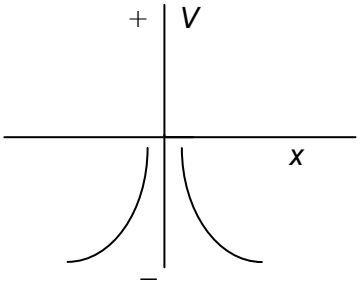
Which one of the following statements is correct?

A The electron follows a circular path in the field.
B The force on the electron acts vertically downwards in the field.
C There is no change in the speed of the electron.
D The electron accelerates whilst in the field.

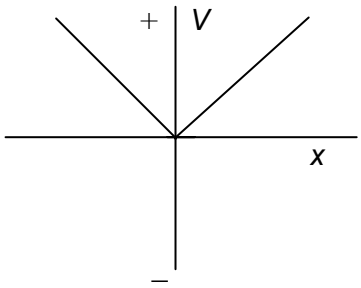
18 Which one of the following graphs shows how the electric potential *V* due to a negative point charge varies with distance *x* from the charge?



A



B



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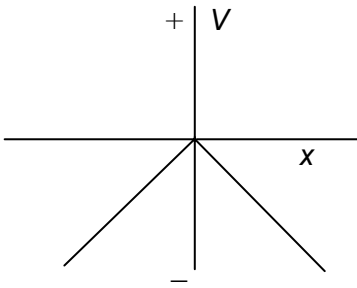
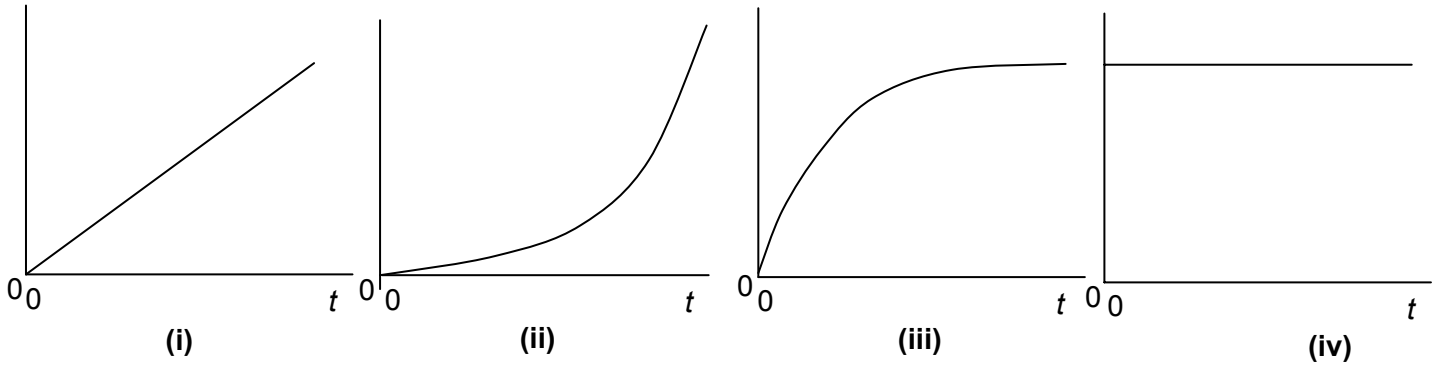


D

19 A capacitor, initially uncharged, is charged by using a **constant** current. The four graphs, **(i)** to **(iv)**, on which both scales are linear, show how quantities could vary with time, *t*, during this charging process.



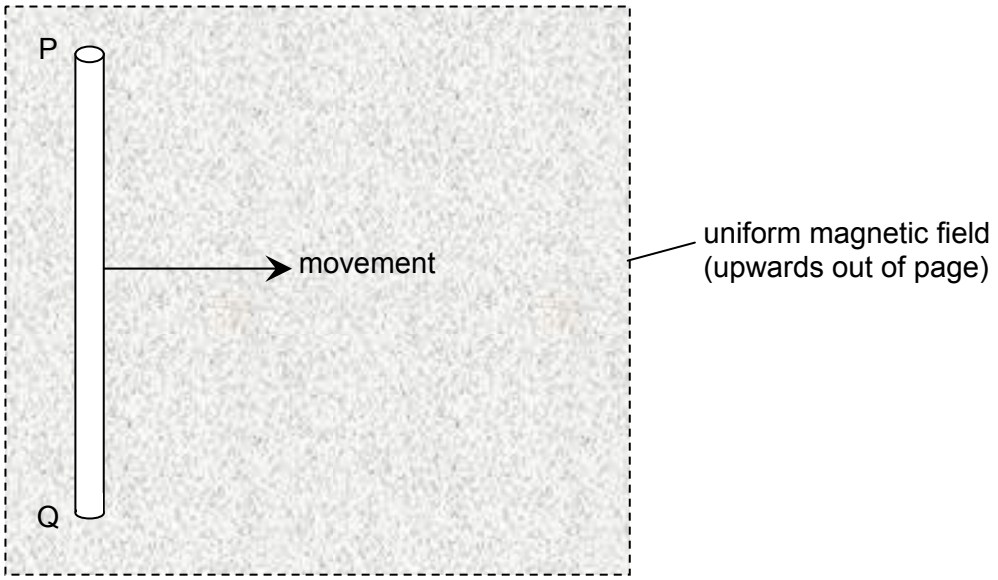
Which line, **A** to **D**, in the table shows correctly the graphs which would represent current against time, and potential difference across the capacitor against time?

	current against time	**pd against time**
A	graph **(i)**	graph **(ii)**
B	graph **(i)**	graph **(iii)**
C	graph **(iv)**	graph **(i)**
D	graph **(iv)**	graph **(ii)**

20 A capacitor charged to a pd of 6.0 V stores a charge of 30 μC. What is the energy stored by the capacitor charged at this pd?

A 5.0×10^{-6} J
B 9.0×10^{-5} J
C 1.8×10^{-4} J
D 5.4×10^{-4} J

21



The diagram shows a conducting wire PQ moving to the right, perpendicularly across a uniform magnetic field that is directed upwards out of the page. A force acts on the free electrons in the wire, causing them to redistribute and produce an emf between the ends of PQ.

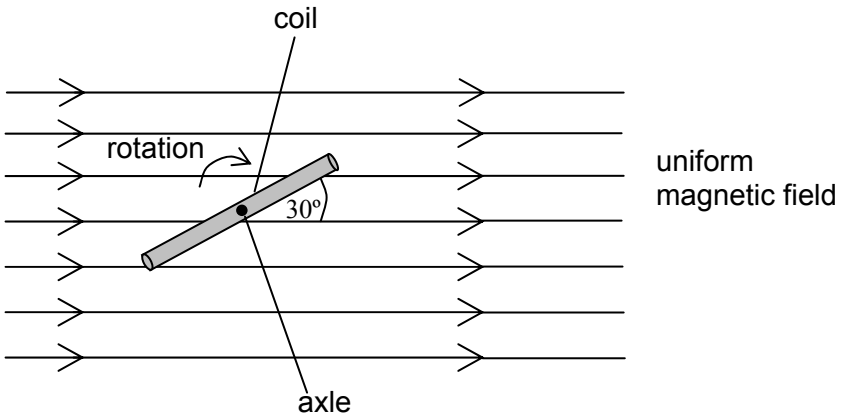
Which line, **A** to **D**, in the table gives the correct direction for the force on the electrons, and the relationship between the electric potentials, V_P and V_Q, of the ends of PQ.

	direction of force on electrons	**potentials of P and Q**
A	from P to Q	$V_P > V_Q$
B	from P to Q	$V_P < V_Q$
C	from Q to P	$V_P > V_Q$
D	from Q to P	$V_P < V_Q$

22 A straight wire of length 0.30 m carries a current of 2.0 A perpendicular to a uniform magnetic field of flux density 5.0×10^{-2} T. Under these conditions, the magnetic force acting on the wire balances its weight, so that the wire is in equilibrium. What is the mass of the wire?

A 8.0×10^{-4} kg
B 3.1×10^{-3} kg
C 3.0×10^{-2} kg
D 8.2×10^{-1} kg

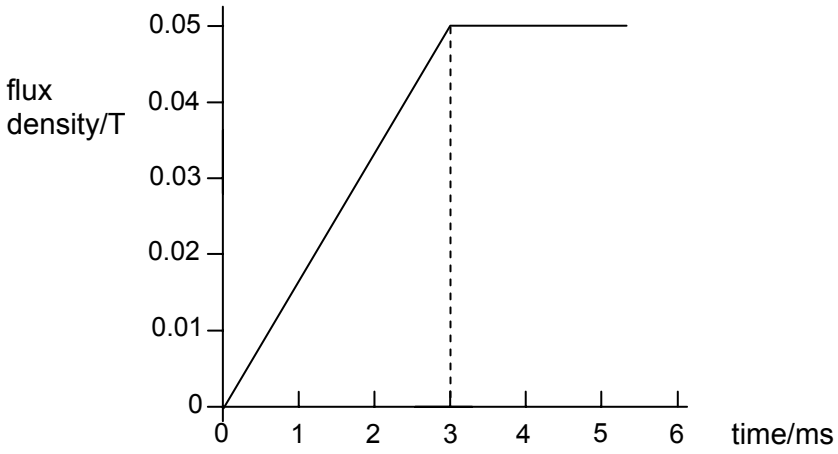
23



A 1200-turn coil, of area $3.0 \times 10^{-3}\,m^2$, is rotated in a uniform magnetic field of flux density 80 mT. What is the flux linkage when the plane of the coil makes an angle of 30° with the direction of the field, as shown by the front view in the diagram?

A 0.14 Wb turns
B 0.17 Wb turns
C 0.23 Wb turns
D 0.29 Wb turns

24 A coil of 400 turns, each of area $2.0 \times 10^{-4}\,m^2$, is placed with its plane perpendicular to a magnetic field. The magnitude of the flux density of the field varies with time as shown in the graph.



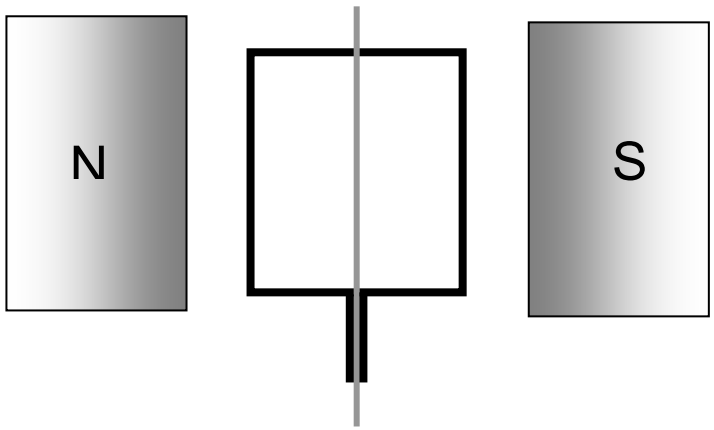
What is the emf induced in the coil during the first 3.0 ms?

A zero
B 1.3×10^{-3} V
C 3.3×10^{-3} V
D 1.3 V

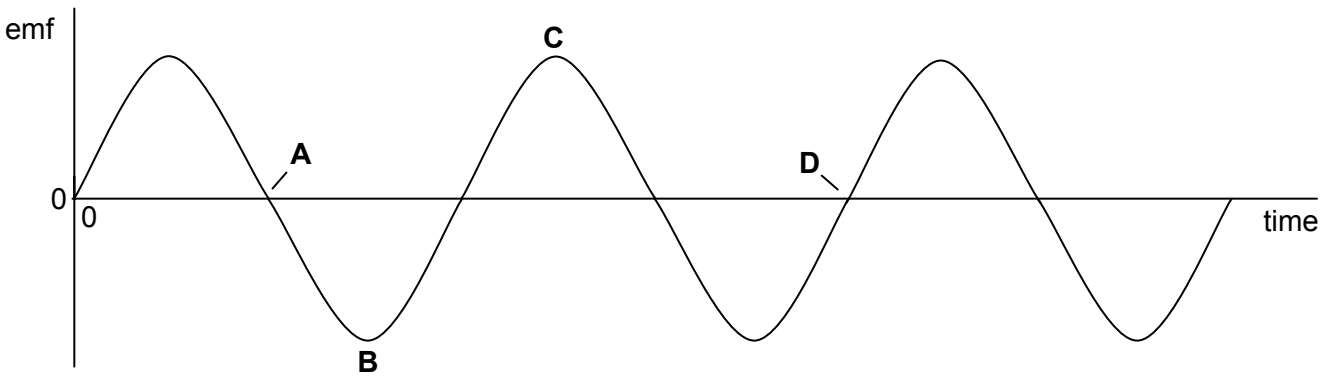
25 An aluminium ring is placed with its plane perpendicular to a magnetic field. The field increases at a uniform rate of 3.0 Ts^{-1}. If the effective cross-sectional area of the ring is $1.0 \times 10^{-2}\,m^2$, what emf is induced in the ring?

A 15 mV
B 30 mV
C 45 mV
D 60 mV

26 The diagram shows a rectangular coil in a uniform magnetic field. The axis of the coil is perpendicular to the direction of the magnetic field.



The graph shows how the induced emf changes with time when the coil spins at constant frequency. At which point on the graph is the flux linkage through the coil zero and decreasing?



27 A 500 turn coil of area 20 cm^2 rotates uniformly at 30 revolutions per second about an axis perpendicular to a uniform magnetic field of flux density 0.50 T. What is the peak emf induced in the coil?

A 94 V
B 1.5×10^3 V
C 1.5×10^5 V
D 9.4×10^5 V

28 A step-up transformer which has a 100 turn primary coil is to be used to transform an alternating pd to 120 V. Which line, **A** to **D**, in the table gives the primary pd and number of turns on the secondary coil for this task?

	primary pd/V	**number of secondary turns**
A	6.0	1000
B	6.0	2000
C	9.0	1000
D	9.0	2000

29 Which one of the following features would **not** improve the efficiency of a transformer?

A thermal lagging around the coils
B a core which is laminated
C a core made from a material which is magnetically soft
D thick, low resistivity wire for the high current winding

30 A high voltage power line consists of cables of total resistance 50 Ω. The power line delivers 3.6 MW at 120 kV. What is the power dissipated in the power line due to the heating effect of the electric current?

A 45 kW
B 72 kW
C 192 kW
D 288 kW

END OF QUESTIONS

Keys to Objective Test Questions

This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

	Keys to Objective Test Questions															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
	C	A	C	B	A	B	D	D	C	A	C	C	D	C	C	
	16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	
	C	D	A	C	B	D	B	A	D	B	C	A	B	A	A	