NATIONAL UNIVERSITY OF SINGAPORE

CG1111 – ENGINEERING PRINCIPLES AND PRACTICE I

QUIZ #1

05 OCTOBER 2019

INSTRUCTIONS:

1. This paper contains **15** multiple-choice questions (MCQs), with only a **SINGLE** correct answer each.

2. Answer **ALL** questions.

3. Use only **2B pencils** to shade the bubble sheet.

4. This is an **OPEN-BOOK** test.

5. There is no restriction on the use of programmable calculators.

6. There is **no penalty (i.e., no negative marks) for wrong answers**. Please attempt all questions.

7. You are **NOT ALLOWED** to use your **mobile phone, tablet** or **computer** during the test.

8. **DO NOT READ** the questions until you are told to do so.

9. Time allowed: **75 MINUTES**

10. After the quiz, please remain seated while we tally the number of submitted scripts.

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1. What is the discharge current of a 14.4 Wh battery operating at 2.4 V and 1.6C?

   (A) 3750 mA

   (B) 23.04 A

   (C) 9600 mA

   (D) 9 A

2. Calculate the number of batteries in series and the number of parallel branches required in a battery pack for a wireless Bluetooth speaker consisting of Lithium Ion batteries, to last a period of 7 hours. The mid-point voltage per battery for the required maximum instantaneous C rate is 3.65 V. Single battery capacity at the maximum allowable 80% depth of discharge (same as end of discharge) is 5000 mAh. The required operating voltage is 13 V. The Bluetooth speaker consists of 3 subsystems working in parallel with the following power efficiencies: $\eta 1 = 90\%$, $\eta 2 = 85\%$, $\eta 3 = 94\%$, and each subsystem's output power is 20 W.

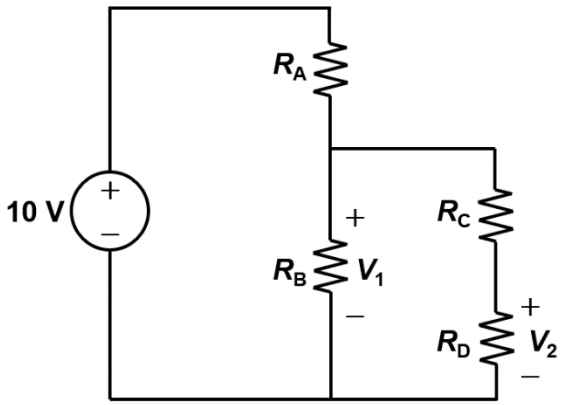
   (A) 4 batteries in series, 7 branches in parallel

   (B) 3 batteries in series, 8 branches in parallel

   (C) 4 batteries in series, 8 branches in parallel

   (D) 3 batteries in series, 7 branches in parallel

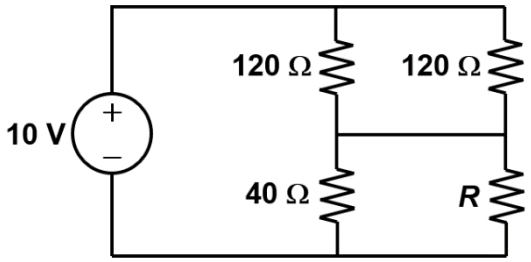
3.



Benedict, who'd just learnt about the voltage divider principle, is excited about applying it to build a circuit shown in the figure above. He wishes to obtain V_1 = 6 V, and V_2 = 2 V. However, he does not realize that he cannot apply the principle directly to R_A and R_B, as resistors R_C and R_D have a "loading effect". Which one of the following sets of resistor values would allow him to get V_1 and V_2 to be closest to his desired voltages of 6 V and 2 V, respectively?

	R_A	R_B	R_C	R_D
(A)	40 Ω	60 Ω	400 Ω	200 Ω
(B)	40 Ω	60 Ω	4000 Ω	2000 Ω
(C)	400 Ω	600 Ω	40 Ω	20 Ω
(D)	4000 Ω	6000 Ω	40 Ω	20 Ω

4.



What is the value of R that will result in a current of 0.1 A passing through R?
(Hint: Use Thevenin equivalent circuit)

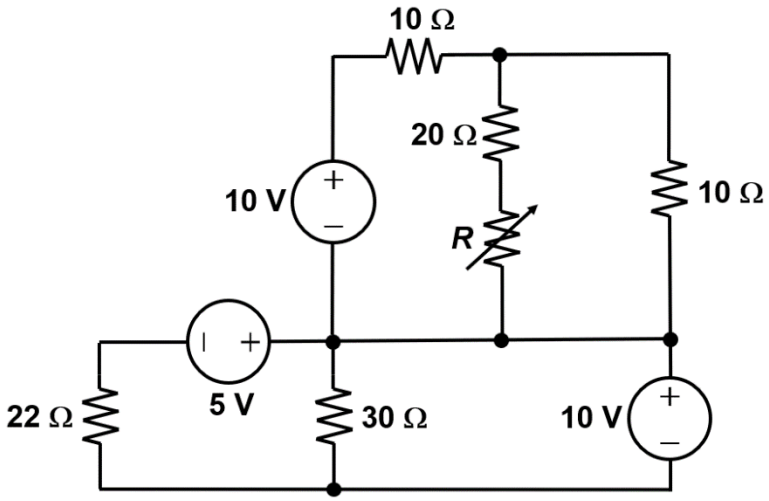
(A) 56 Ω

(B) 24 Ω

(C) 40 Ω

(D) 16 Ω

5.



What is this maximum power that can be utilized by the load *R*?

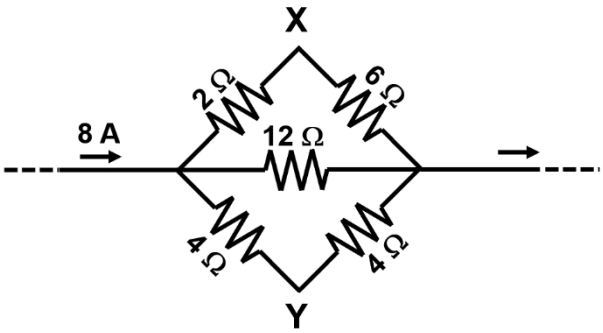
(A) 0.25 W

(B) 1 W

(C) 1.56 W

(D) 6.25 W

6.



A current of 8 A flows through a resistor network as shown in the figure above. The voltage difference V_{XY} (given by $V_X - V_Y$) is

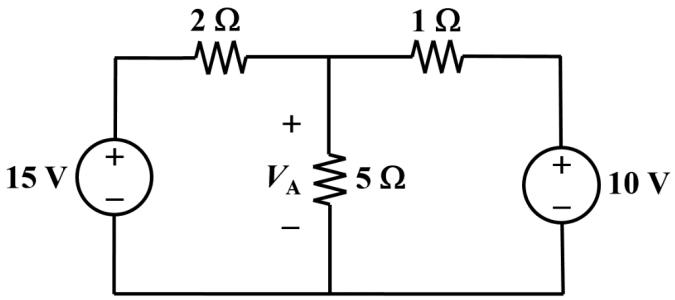
(A) 12 V

(B) 6 V

(C) 4.57 V

(D) 11.4 V

7.



For the circuit shown in the figure above, what is the voltage V_A?

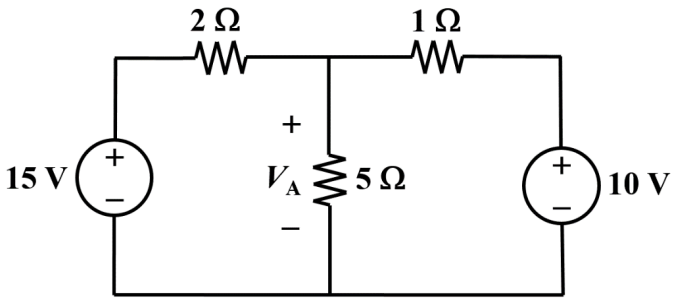
(A) 12.1 V

(B) 11.7 V

(C) 11.3 V

(D) 10.3 V

8.



For the circuit shown in the figure above, the 10 V voltage source is

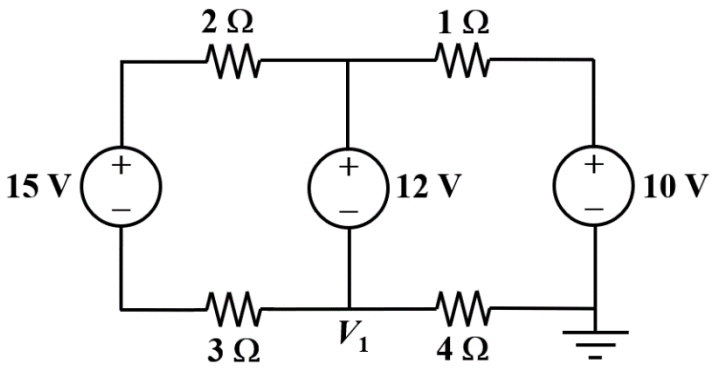
(A) supplying a power of about 28 W.

(B) consuming a power of about 21 W.

(C) consuming a power of about 3 W.

(D) consuming a power of about 13 W.

9.



For the circuit shown in the figure above, what is the voltage V_1 with respect to ground?

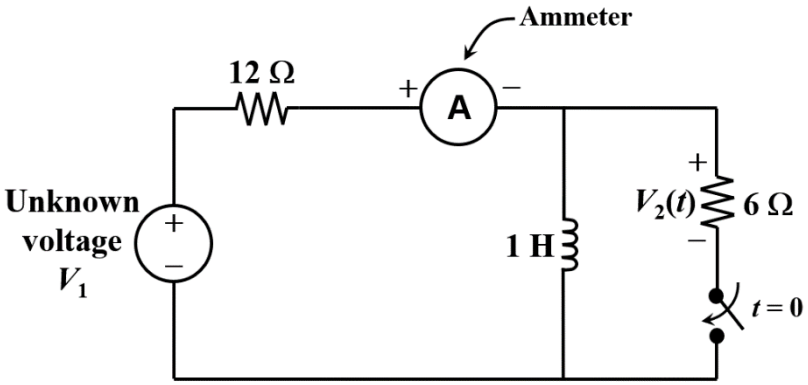
(A) 3.4 V

(B) −3.4 V

(C) 1.6 V

(D) −1.6 V

10.



For the circuit shown in the figure above, the switch has been opened for a long time, and the current measured by the ammeter was 1 A before time $t = 0$. At time $t = 0$, the switch is closed. What would be the voltage $V_2(t)$ at time $t = 0^+$ s?

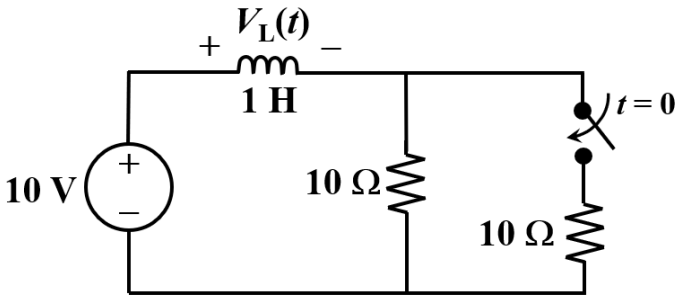
(A) 0 V

(B) −6 V

(C) 4 V

(D) 6 V

11.



In the circuit shown in the figure above, the switch was initially OPEN for a long time. At time t = 0, the switch is closed. What is the inductor's voltage $V_L(t)$ at time t = 0.2 s?

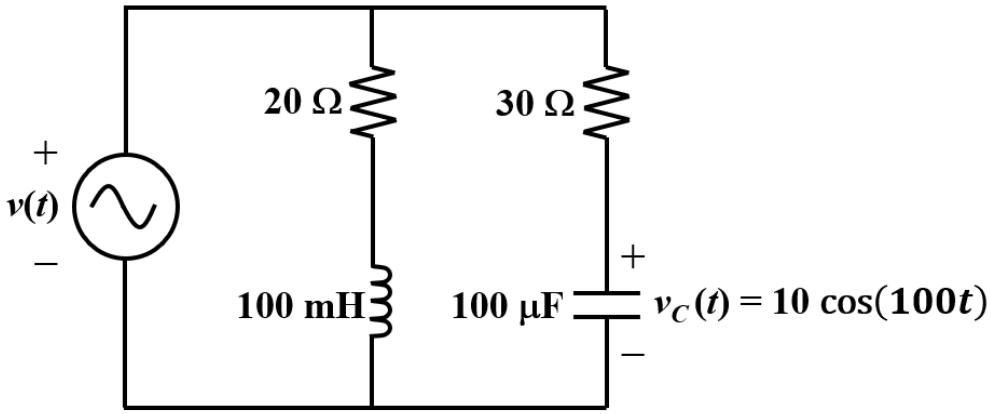
(A) 8.16 V

(B) 1.84 V

(C) 6.32 V

(D) 3.68 V

12.



In the circuit shown in the figure above, the voltage $v(t)$ is

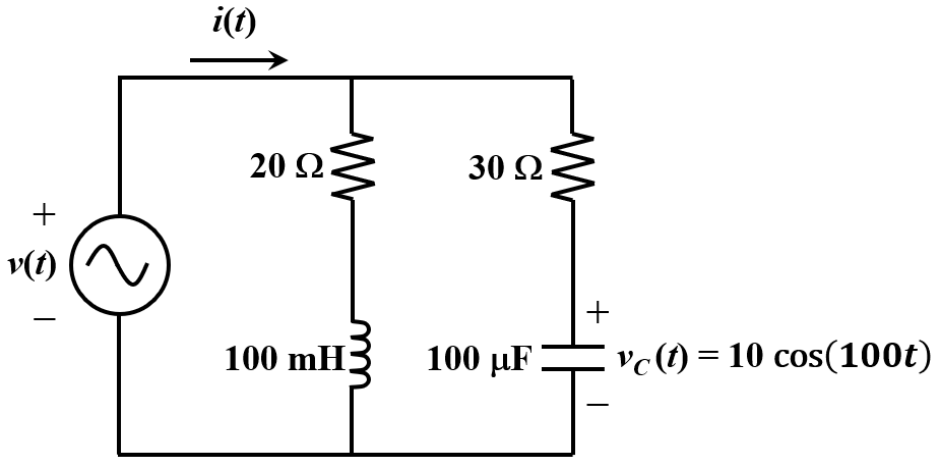
(A) 9.58 cos(100t – 16.7°) V

(B) 9.58 cos(100t + 16.7°) V

(C) 10.4 cos(100t + 16.7°) V

(D) 10.4 cos(100t – 16.7°) V

13.



In the circuit shown in the figure above, the current $i(t)$ is

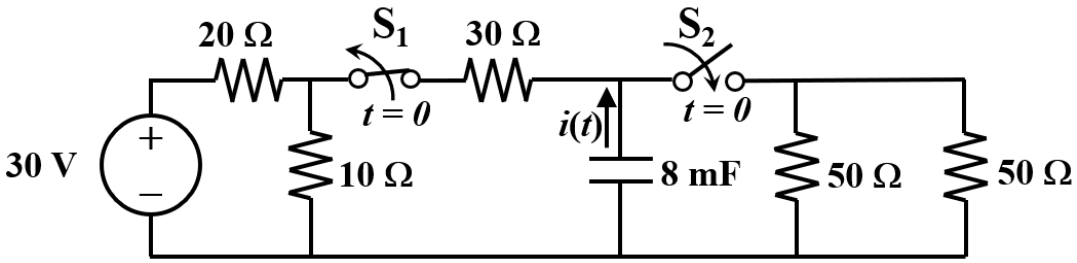
(A) 237 cos(100t + 30.9°) A

(B) 2.17 cos(100t – 2.5°) A

(C) 0.46 cos(100t + 2.5°) A

(D) 0.54 cos(100t – 17.6°) A

14.



In the circuit shown in the figure above, switch S_1 was CLOSED and switch S_2 was OPEN for a long time before time t = 0. At time t = 0, both switches are flipped (i.e., S_1 becomes OPEN, and S_2 becomes CLOSED). What is the capacitor's current $i(t)$ at time t = 0.2 second?

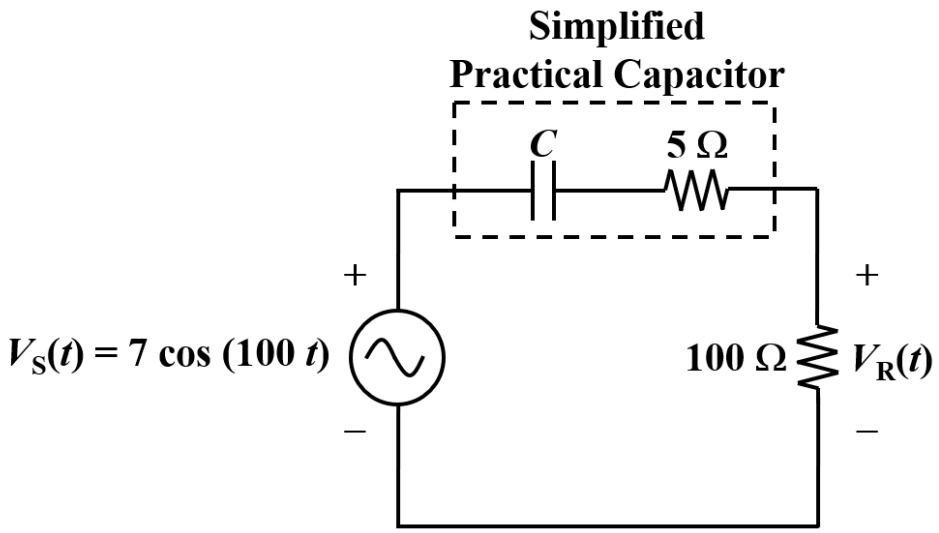
(A) 0.147 A

(B) 0.253 A

(C) 3.68 A

(D) 73.6 mA

15.



In the circuit shown in the figure above, a 100 Ω resistor is connected in series with a practical capacitor. The practical capacitor has a series resistance of 5 Ω, and an unknown capacitance *C*. Suppose the phase angle of the voltage $V_R(t)$ is found to be 43.6° with respect to the source voltage $V_S(t)$, the capacitance *C* can be obtained as:

(A) 10 μF

(B) 100 μF

(C) 1 mF

(D) 10 mF

END OF PAPER